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CHARLES ATWOOD KOFOID

JOSEPH GRINNELL



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Four Californian species of the genus *Dipodomys* to show comparative coloration. 1 *D. heermanni californicus* Merriam. 2 *D. morroensis* (Merriam). 3 *D. mollicaudatus* Grinnell. 4 *D. ordii monensis* Grinnell. About  $\times 2$ .

**A GEOGRAPHICAL STUDY OF THE  
KANGAROO RATS OF CALIFORNIA**

**BY  
JOSEPH GRINNELL**

**UNIVERSITY OF CALIFORNIA PUBLICATIONS IN ZOOLOGY**

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# A GEOGRAPHICAL STUDY OF THE KANGAROO RATS OF CALIFORNIA

BY

JOSEPH GRINNELL

(Contribution from the Museum of Vertebrate Zoology of the University of California)

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## INTRODUCTION

The kangaroo rats (genus *Dipodomys*) comprise a sharply set off group of rodents belonging to the family Heteromyidae. This family has its affinities with the squirrels rather than with the rats and mice; in other words, it belongs to the superfamily Sciuroidea (*vide* Miller and Gidley, 1918, p. 434). The family is restricted in its occurrence to the New World and the genus to North America, more particularly to the warmer and at the same time more arid portions of this continent.

The metropolis of the genus *Dipodomys*, as regards speciation, is situated in the southwestern United States. Furthermore, thirty-three species and subspecies exist within the boundaries of the single state of California, as many forms as occur all told outside of this state and at the same time do not reach into it. The content of the genus *Dipodomys* has seemingly reached its greatest degree of evolutionary differentiation within the confines which happen to mark off this one state, and therein is also manifest great climatic diversity because of greatly varying altitude and varying exposure to the influences of the sea.

The present study deals with only those species and subspecies of *Dipodomys* that occur within the boundaries of California. While the systematic phase of the inquiry has been carried out conscientiously, to the limits here set, the main purpose has been to ascertain the degree of correlation which exists between speciation and geography and environment. Concentration upon the species and areas I personally know from field experience has therefore been chosen in preference to the purely systematic type of revision which would involve all the known species of the genus. It has been felt that the inquiry could not have been made more extensive without sacrificing in some measure its intensiveness.

## MATERIALS AND ACKNOWLEDGMENTS

During the past twelve years the Museum of Vertebrate Zoology has gathered 2212 skins-with-skulls of kangaroo rats from California, representative of 213 localities. As a rule the accumulation of these specimens has been incidental to the collection of general vertebrate material. But of late years special efforts have been made to obtain series of topotypes of all the species previously named but not already represented in this Museum. Furthermore, special trips were made to several localities heretofore unsearched for kangaroo rats, wherein, on theoretical grounds, the existence of other distinct forms was predicted. The results were not often disappointing. The great majority of the specimens gathered consist of the conventional, fully labeled, study-skin and skull, but there is also a goodly number of complete skeletons and alcoholics.

The Museum's own store of material constitutes the main basis of the present study, but additional specimens were borrowed from a number of other institutions and private collectors, the most important outside source being the Bureau of Biological Survey of the United States Department of Agriculture. Through the kindness of Dr. Edward W. Nelson, Chief of the Bureau, 409 specimens of kangaroo rats, representing species and localities of special importance to the writer, were shipped on from Washington. Other institutions and individuals to whom the writer is indebted for the loan of material are as follows: The Academy of Natural Sciences, Philadelphia, through its Executive Curator, Dr. Witmer Stone; the American Museum of Natural History, New York, through its Curator of Mammals, Dr. J. A. Allen; the California Academy of Sciences, through its Director, Dr. Barton W. Evermann; Leland Stanford Junior University, through Professors Charles H. Gilbert and John O. Snyder; Mr. Donald R. Dickey, of Pasadena; Mr. A. Brazier Howell, of Pasadena; Mr. J. Eugene Law, of Berkeley; and Mr. Frank Stephens, of San Diego.

Some of the borrowed specimens represented localities outside of California. Only those from within the state are listed in the paragraph on distribution in the account of each species; and all such specimens are accompanied by indication of source. All specimens

cited are contained in the Museum of Vertebrate Zoology unless otherwise indicated. They are, of course, available for reëxamination at any time by students of the genus. The total number of specimens listed here as from California is 2834.

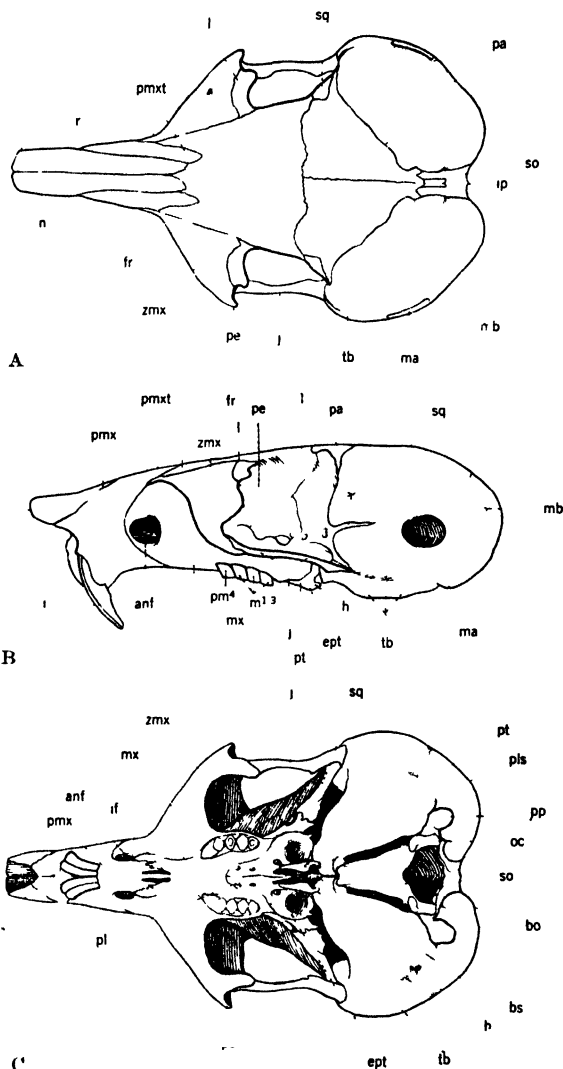
Plates 1 (frontispiece) and 2 were drawn by Louis Agassiz Fuertes, and text figures A to D, I to R, and V were drawn by Frieda Abernathy.

It is obvious that in a study of this sort availability and adequacy of materials, and favorable opportunities for work, are absolutely prerequisite. These essentials have been provided in liberal measure by Miss Annie M. Alexander, founder and constant patron of the California Museum of Vertebrate Zoology. To her the writer is indebted also for her personal work in the field whereby special toptype series of *Dipodomys*, necessary to the proper understanding of the group, were obtained.

## METHODS OF MEASURING

Measurements of total length, tail vertebrae, hind foot, and ear from crown, and all weights, are given as taken by the collector in the field and recorded on the label attached to the skin. Exceptions occur in a very few cases and these are definitely specified as contrary to the rule just stated. All measurements of skulls, and all averages, have been made by the writer himself, except for the few cases (and then so specified) where measurements have been quoted from other authors. All measurements are given in millimeters and tenths of millimeters. *Total length* is the distance (with body and tail straightened out) from the tip of the nose to the tip of the last caudal vertebra, taken usually after skinning. If this measurement is taken in kangaroo rats before skinning, there is a chance of error because the skin sometimes slips backward some millimeters free from the actual tip of the vertebral series. *Tail vertebrae* is length of tail alone, from a point on upper side at base where tail can be bent at right angles to back, to tip (as just designated). *Hind foot* is measured from the posteriormost point on the heel to tip of longest claw. *Ear from crown* is distance from hinder (median) base of ear to farthest (topmost) point on rim of pinna, when latter is extended upright.

*Greatest length of skull* is taken parallel to axis of skull with one jaw of calipers touching anterior tips of the two nasals and the other



Figs A, B, C Three views of skull of *Dipodomys ingens*, no 14447, ♂, labeled to show application of terms used in present paper  $\times 1\frac{1}{2}$

Explanation n, nasal, pmx, premaxilla, i, incisor tooth, if incisive foramen, mx, maxilla, zmx, zygomatic process of maxilla (or simply "maxillary arch"), j, jugal (or malar), fr, frontal, anf, ante orbital foramen, l lachrymal, pl, palatine, pls palatal spine, pt, pterygoid, h, hamular process, pm<sup>4</sup>, upper premolar four, m<sup>1-3</sup>, upper molars one to three, r rostrum of skull, pe, postero external angle of maxillary arch, pmxt, premaxillary tongue, ept, external pterygoid plate, mb, mastoid bulla, tb, auditory bulla (petrosal + tympanic), ma, external auditory meatus, pa, parietal, sq, squamosal, so, supra occipital, ip, interparietal, pp, paroccipital process, bs, basisphenoid, bo, basioccipital, ptf, pterygoid foramen, pn, posterior nares, oc, occipital condyle

jaw touching the most posterior points on the two backward bulging bullae. *Breadth of skull across bullae* is the widest possible transverse dimension of the skull, taken at right angles to its axis. *Spread of maxillary arches* is taken at right angles to axis of skull from farthest point on tip of one maxillary arch to same point on the other. *Greatest length of nasals* is taken parallel to axis of skull with the jaws of the calipers touching the extreme opposite tips of both nasals. *Greatest width of rostrum near end* is taken in front of the faces of the incisors and is practically the greatest width of the two nasals as they lie in

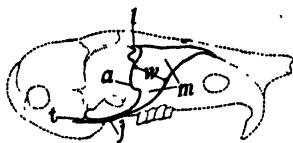


Fig. D. Lateral outline of skull of *Dipodomys panamintinus*, no. 26889, ♂, to show structures anterior to orbit; X l; m, zygomatic process of maxilla, or simply "maxillary arch"; w, the dimension "width of maxillary arch at middle"; a, postero-external angle of maxillary arch; l, lachrymal; j, jugal, or malar; t, zygomatic process of temporal.

normal position and are viewed from above. *Width of maxillary arch at middle* is taken across right-hand arch just to outer side of lacrimal and at right angles to its anterior edge (see fig. D).

All through this paper, where the material was extensive enough to permit it, measurements are given for ten adults, five of each sex. By adult is meant an individual in which the molariform teeth show an advanced stage of wear on their exposed ends. Specimens which seem to be full grown but which do not show much progress in this process of tooth wear are termed subadult. Some of these subadults have at times been chosen (and then so stated) to fill out the desired ten. When there have been long series of adults to select from, extremes in size have been chosen to include in the ten, always excluding any defectives, that is, any that have deformed tails or broken skulls.

As elsewhere stated, the two sexes in *Dipodomys* appear to be indistinguishable as regards both general size and proportions of parts. This likeness extends to skull and teeth. All measurements and averages are therefore handled irrespective of sex.

With the exception of such general or vague terms as "blackish," "dusky," or "whitish," the color names here employed have been

taken from Ridgway's *Color Standards and Color Nomenclature* (1912) upon direct comparison of study skins with the color plates in that work.

## SUBDIVISIONS OF THE GENUS *DIPDOMYS*

The supposed genus *Perodipus* Fitzinger (1867, p. 126) (i.e., *Dipodops* Merriam, 1890a, pp. 72-73, 1890b, p. 41, and 1892, p. 26, footnote) was generally recognized as distinct from the genus *Dipodomys* (Gray, 1841, p. 521), in a restricted sense, at a time when relatively few species of kangaroo rats had been discovered, and before the fact had become clearly apparent that the reduction of toes on the hind foot to four is an inconstant feature in certain species. Furthermore, the cranial characters suggested for the two supposed genera have none of them proved to exist correlatively with the condition of the toes. The present writer has closely examined the skulls of all the kinds of kangaroo rats found in California, and of some kinds from outside this state, and he has failed to find any one cranial feature that in his opinion could be used decisively to establish any generic or even subgeneric division within the group as a whole. *Dipodomys deserti*, of all the different species, would seem to constitute a type most different from the rest; but an analysis of its characters will, it is believed, convince anyone who familiarizes himself with the group that none is of more than specific importance.

The recognition of *Perodipus* as a subgenus based on the four-toed versus five-toed feature cannot serve usefully even on grounds of pure convenience, because it throws together forms in other respects widely dissimilar. This feature surely has no special phylogenetic significance. For example, *Dipodomys californicus* is certainly of very recent and incomplete differentiation from *Dipodomys heermanni* (= "*Perodipus*" *striator* of late literature); the first is four-toed (normally), the second five-toed. In fact, the two, upon this criterion of complete inosculation through individual variation in characters as well as of almost complete geographic intergradation, merit but consubspecific ranking in nomenclature. The unstable nature of the toe-characters in the kangaroo rats is discussed more fully later (see p. 21).

As will become apparent (see especially p. 10), the genus *Dipodomys*, as it stands, is, in the writer's conception, a remarkably homogeneous and compact assembly of species. All the species are very

much alike, even down to very small details of external structure. And yet it has proved possible to recognize groupings of the species within the genus, convenient in determining the sequence of names in a linear arrangement. Furthermore, these "groups" are believed to be "natural groups" and hence to show phylogenetic relationships in some measure. In the following list of names, the 33 species of kangaroo rats occurring in California are arranged by groups from what appears to be the most generalized type to the most specialized.

#### HEERMANNI GROUP

*Dipodomys heermanni californicus* Merriam  
*Dipodomys heermanni eximius* Grinnell  
*Dipodomys heermanni heermanni* LeConte  
*Dipodomys heermanni tularensis* (Merriam)  
*Dipodomys heermanni dixonii* (Grinnell)  
*Dipodomys heermanni berkeleyensis* Grinnell  
*Dipodomys heermanni goldmani* (Merriam)  
*Dipodomys heermanni jolonensis* Grinnell  
*Dipodomys heermanni swarthii* (Grinnell)  
*Dipodomys morroensis* (Merriam)  
*Dipodomys mohavensis* (Grinnell)  
*Dipodomys leucogenys* (Grinnell)  
*Dipodomys panamintinus* (Merriam)  
*Dipodomys stephensi* (Merriam)  
*Dipodomys ingens* (Merriam)

#### ORDII GROUP

*Dipodomys ordii columbianus* (Merriam)  
*Dipodomys ordii monoensis* (Grinnell)

#### MERRIAMI GROUP

*Dipodomys merriami merriami* Mearns  
*Dipodomys merriami simiolus* Rhoads  
*Dipodomys merriami parvus* Rhoads  
*Dipodomys nitratoides nitratoides* Merriam  
*Dipodomys nitratoides exilis* Merriam  
*Dipodomys nitratoides brevinasus* Grinnell

#### AGILIS GROUP

*Dipodomys agilis agilis* Gambel  
*Dipodomys agilis simulans* (Merriam)  
*Dipodomys agilis cabezonae* (Merriam)  
*Dipodomys agilis perplexus* (Merriam)  
*Dipodomys venustus venustus* (Merriam)  
*Dipodomys venustus sanctiluciae* Grinnell  
*Dipodomys elephantinus* (Grinnell)

#### MICROPS GROUP

*Dipodomys microps* (Merriam)  
*Dipodomys levipes* (Merriam)

#### DESERTI GROUP

*Dipodomys deserti* Stephens

It has been impossible to build a "natural" key that will allocate all the species correctly under these groups. It is the special aggregation or combination of characters which goes to form the concept of any group in one's mind. The following synopsis of the groups is offered with due appreciation of the vagueness appertaining to the diagnoses.

*Heermanni group*.—Kangaroo rats of medium to very large size; maxillary arches very broad, widely spreading, and, as a rule, with postero-external angles prominent and sharp; rostrum heavy to fairly slender; bullar inflation relatively small to moderately great; supra-occipital and interparietal very broad to rather narrow; tail variable, relatively very long to rather short, in any event of moderate thickness; ear relatively small to moderate in size; hind foot relatively heavy; claw and phalanges of first toe on hind foot either present or absent, but metatarsal, at least, of this toe always (so far as known) well developed, relatively speaking.

*Ordii group*.—Kangaroo rats of medium to small size; maxillary arches broad, spreading fairly widely, as a rule, and with angles more or less well developed; rostrum moderately heavy; bullae variable but not reaching an extreme as to size in either direction; supra-occipital and interparietal broad to moderate in width; tail very short, relatively speaking, to moderate, rather thick; ear very small to moderate in size; hind foot of fair average build; first toe and claw on hind foot always (so far as known) present.

*Merriami group*.—Kangaroo rats of moderately small to smallest size; maxillary arches broad, widely spreading, and sharply angled; rostrum very slender; bullar inflation moderate to small; supra-occipital and interparietal moderate in width to narrow; tail of moderate length, slender; ear small; hind foot slender; first toe and claw on hind foot never (so far as known) in evidence—metatarsal, even, rudimentary.

*Agilis group*.—Kangaroo rats of medium to large size; maxillary arches rather narrow, narrowly spreading, and, as a rule, weakly angled; rostrum relatively heavy; bullar inflation moderate to great; supra-occipital and interparietal broad to rather narrow; tail rather long and of moderate thickness; ear large to largest; hind foot heavy; first toe and its claw, on hind foot, usually present—claw and phalanges sometimes missing, but metatarsal always (so far as known) well developed.

*Microps group*.—Kangaroo rats of medium to small size; maxillary arches very narrow, spreading narrowly, and very weakly angled;



rostrum fairly slender; bullar inflation moderate to great; supra-occipital and interparietal moderate in width to narrow; tail rather short and thick; ear small; hind foot rather heavy; first toe on hind foot, and its claw, always (so far as known) present.

*Deserti group.*—Kangaroo rats of very large size; maxillary arches extremely narrow, with very narrow spread, and with postero-external angles indicated but faintly; rostrum relatively weak; bullar inflation relatively enormous; supra-occipital and interparietal so extremely narrow as usually to be invisible when skull is viewed dorsally, by reason of close approach of swollen mastoid bullae; tail of relatively moderate length, rather thick; ear moderate in size; hind foot relatively heavy; first toe and claw on hind foot never (so far as known) in evidence—metatarsal, at best, a mere rudiment.

## THE SPECIFIC AND SUBSPECIFIC CHARACTERS IN DIPODOMYS

*Characters common to all the forms.*—The uniformity obtaining in a great many respects throughout all the species of the genus *Dipodomys* is striking. In other words, the species comprising this genus possess many conspicuous features in common, and where these differentiate them from any or all of the other near-related genera (*Microdipodops*, *Perognathus*, *Heteromys*, *Liomys*), they become generic characters.

The more prominent of the external features which characterize all the kangaroo rats in common are briefly as follows (see also pls. 1, 2, 7): diversity between fore and hind pairs of limbs extreme; hind pair greatly elongated, with pes very stout and with hallux reduced to a rudiment or wanting altogether; front pair very weak, but with relatively long slender claws; mode of progression, saltatorial, nearly or quite exclusively maintained by the hind limbs acting simultaneously. Tail very long, always longer than body alone, and always more heavily haired at end than basally, so that a tuft or terminal crest is formed. Ears orbicular or subquadrate, lying flatly back against sides of head. Head broad, closely joined to body without any obvious neck; eyes, large-appearing; nose pointed; fur-lined cheek-pouches commodious, and completely evertible.

Pelage, relatively very long and of silky texture; hind feet and toes fully haired beneath, no naked "tubercles" showing.

As to coloration of pelage, there is remarkable constancy in pattern: lower surface of body, entire fore legs and feet, and upper surface of hind feet, pure white, abruptly outlined against dark areas. More or less dark upper surface of body, from nose to tip of tail, quite uniform, save as relieved in most species by black or dusky markings on face and by white or whitish spots above eyes and at bases of ears; outside of each thigh with a patch colored like back, this patch separated from adjacent dorsal area by a sharp band of white continuous with white of lower surface at either end; tail usually four-striped, the two lateral stripes white, the dorsal and ventral, black, dusky, or of color of dorsum of body; these dark stripes cut off from body color by complete ring of white around base of tail (see pl. 7).

An ideally complete and vivid description of the skull and teeth of adult *Dipodomys* has been given by Coues (1875, pp. 307-317). It is not necessary, therefore, to go into this subject here. In the paragraphs next following the various characters of *Dipodomys*, both external and cranial, are discussed with especial reference to their variability from species to species.

*Dorsal gland.*—In all our kangaroo rats, as far as enquiry in this regard has been carried, there is to be found on the middle of the back between the shoulders a sort of dermal "gland," the presence of which affects in some measure the dorsal coloration. This "gland" consists of a slight thickening of the skin marked by a superficial scurfiness; it is present in both sexes, and in small young as well as in old adults. In the dry skin the spot can usually be found by running the finger-nail up and down the back, when more or less of a roughness will be encountered. Sometimes this spot reaches the condition of a scab-like excrescence as much as six millimeters long by four millimeters wide. As a result the pelage is more or less separated at the base, according to the size of the scab, and the slate-gray basal portions of the hairs that are uncovered show through, producing thus the effect of a dark mid-dorsal patch.

This mid-dorsal gland varies in degree of development individually, but, as previously intimated, this degree of development does not seem to be correlated with sex, nor even with season of the year. The gland may nevertheless be supposed to serve in the locating of one individual by another through the sense of smell.

*Quality and length of pelage.*—*Dipodomys* possesses as one of its good generic characters a coat of hairs which are peculiarly long and fine, yet there is some variation in the degree of this "silkeness"

among the constituent species. The sense of touch by which this more-or-less silkiness of the overhairs can be appreciated is, of course, relatively gross, so that it betokens decided structural differences in the hairs concerned such as would doubtless yield good quantitative characters if subjected to appropriate study. Suffice it here to point out that *deserti*, and those members of the *merriami* group which live in the region east of the desert divides, show the extreme of silkiness, while certain of the forms of the region toward the seacoast from the deserts show the coarser type.

A rather striking example of this difference in quality of pelage is shown within the *merriami* group, where *simiolus* and *parvus*, of the Colorado Desert and San Jacinto subfaunal districts, respectively, show readily appreciable difference in degree of silkiness even though but subspecifically separated. Also, in the same group, *merriami*, of the Mohave Desert, differs in the same way from the three races of *nitratoides*, of the San Joaquin Valley.

In the *agilis* group, *venustus*, of the Santa Cruz subfaunal area, is distinctly coarser in pelage than *cabezona* of the western rim of the Colorado Desert; and the rest of the forms in this group seem to lie between these extremes. In the *heermanni* group, *mohavensis* is certainly softer pelaged than the forms farthest to the westward, such as *ingens*, *berkeleyensis*, and *californicus*.

There is good evidence, therefore, of direct correlation between quality of pelage and some factor of climate, probably humidity of the air: the finest "grained" pelage is possessed by the kangaroo rats living under the most arid conditions, and, conversely, the coarsest haired animals are those dwelling in the most humid, coastal regions.

*Coloration*.—Coloration resolves itself into general tone, or mass effect, and pattern, which involves sharp demarcation of light and dark areas, or "markings." Among the species of *Dipodomys* occurring in California, extremes in both respects are so far apart (compare *morroensis* and *monoensis*, for instance, in plate 1) that, when all the thirty-three species are brought into comparison with one another, many steps of character value are found to exist.

The general tone of coloration, if determined from the mid-dorsum, traverses a scale among the different species and subspecies between very dark tawny-olive overwashed with blackish (in *morroensis*) to pale ochraceous-buff (in *deserti*). The tone of the plumbeous basal portion of the pelage also varies considerably. It must be remembered,

however, that contiguous forms often show sharp contrasts in color, not bridged over even through extremes of individual variation, so that intergradation in the sense in which the student of systematic zoology understands the term does not then exist.

With regard to markings, there are five sets, facial, aural, flank, hind foot, and tail. In the majority of the species the curious arieti-form facial dark marking (see plates 1, 2) extends continuously across the nose from the base of one whisker-tuft to that of the other (two double crescents joined medially, to express the facts in another way). At one extreme in the series of species the facial marking is bold and black; in the opposite direction it becomes almost or quite obliterated. Between these extremes are to be found various interlying conditions, some of them constituting excellent specific or subspecific characters. The color tint of the cheeks and of the circumocular area is also variable, ranging from deeply buffy or dusky to white.

The ear shows in most species a definite color pattern (see fig. I); a buffy, dusky or blackish ground color is set off by more or less white or silvery on the upper folded-over rim of the pinna. But at one extreme is *simiolus*, whose ear is very scantily clothed with only pure white hairs, and at the other extreme is *morroensis*, in which the pinna is nearly solidly blackish. In some members of the *agilis* group the inner surface of the pinna basally is beset with numbers of conspicuous white hairs. The patch of white pelage located at the hinder base of the ear in all species of *Dipodomys* varies considerably in extent. It is so small in a number of the coastal species as to be invisible when the ear lies back in normal position; in other species, notably *levipes*, it is so extensive as to shine forth conspicuously at all times.

The flank patch, in all but one species (*morroensis*) set off by a pure white hip stripe from the rest of the "upper surface," is always similar in color to the mid-dorsum though it may be of a paler tone. Its size is governed by the width of the white hip stripe. In *deserti*, for example, where the white hip stripe is excessively broad, the pale buffy flank patch is small. In *morroensis* the flank patch is extensive, and the hip stripe is encroached upon so as to be in some individuals obliterated save for a pale tawny indication at either end of the path it would ordinarily follow.

The sole of the hind foot is generally marked lengthwise with a broad stripe of dusky or blackish. This stripe becomes restricted in extent, and pale brownish in color, in some of the arenicolous species; and in *deserti* it is obsolete.

While the tail is usually four-striped (dorsal and ventral stripes blackish or dusky, with complementary white stripe on either side), there is much variation in proportion of dark to white. As a rule the dorsal dark stripe is wider than the ventral dark stripe; but of course the two lateral white stripes are of the same width, since bilateral symmetry holds just as precisely with regard to color and markings as it does for more deep-seated ("anatomical") features. Both dark stripes reach their greatest widths in the coastal forms in the *heermanni* group, namely in *goldmani* and *morroensis*. Indeed, in the latter the white side-stripes in some individuals are almost pinched out (see fig. E). On the other hand, not only does the depth of coloring of the dark stripes diminish in the species living toward and within the extremest desert areas, but in adult *deserti* the ventral



Fig. E. Diagrammatic cross sections of tails (each at middle point) of different kangaroo rats, from selected average specimens of each species, to show amounts of blackish or dusky in the dorsal and ventral stripes as compared with width of white side-stripes. 1, *Morroensis*; 2, *goldmani*; 3, *jolonensis*; 4, *mohavensis*; 5, *merriami*; 6, *sumilus*; 7, *deserti*. The proportion of dark to white appears to bear a direct relationship to degree of "wetness" or "dryness" of climate, more especially as to the factor of cloudiness.  $\times$  about 3.

stripe is wanting altogether. The amount of white in the tuft of the tail is also variable, there being more or less mixture or dilution with dusky. Furthermore, in three forms constantly (*deserti*, *californicus*, and *eximius*), and in one form inconstantly (*heermanni*), the end of the tuft is abruptly pure white.

There is, I am sure, no question that degree of pigmentation closely parallels degree of wetness in climate. Very many distantly related groups of birds and mammals show such uniformity in this reaction that the correlation must be accepted as a fact. But "wetness" of climate is not a simple factor: it may involve humidity of the air, cloudiness, or rainfall, or any two of these, or all three.

With the purpose of throwing light on this question there are here presented (figs. F to H) maps of California showing (1) relative humidity of the atmosphere, (2) percentage of cloudiness, and (3) precipitation. It must be granted that, although pains have been taken to get the best available data for use as a basis of these charts, there is still much to be desired. With no doubt whatsoever there is much error in the placement of the lines locally. Meteorological stations are

still few and far between, and some of them are not located so as to afford particularly useful data in the present connection. Also observations are altogether lacking at points from which climatic data are most needed. But even so, the charts here presented, when compared

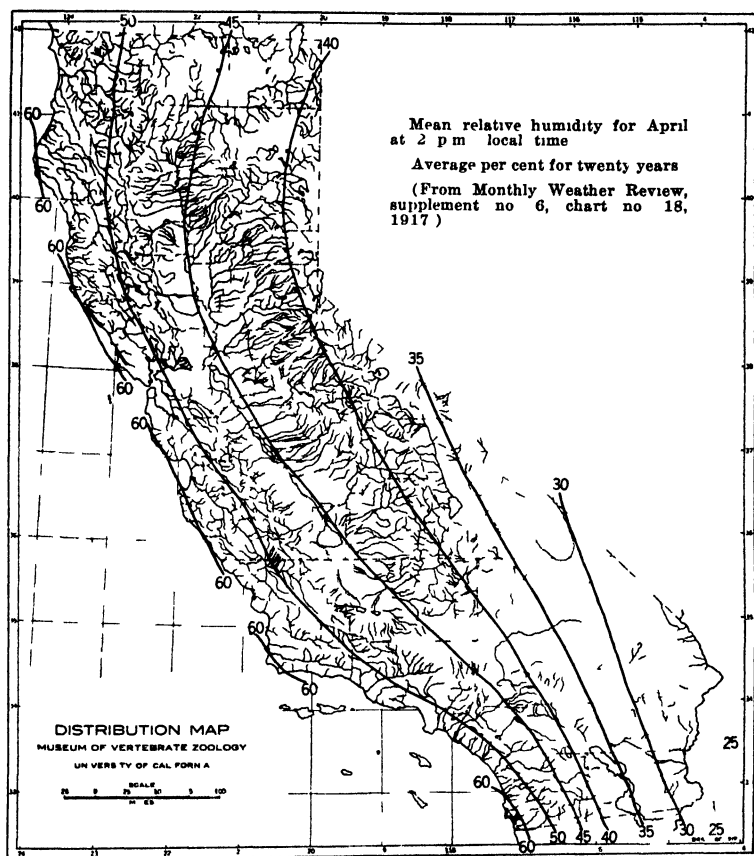


Fig F. Map showing relative humidity of the air, for the month of April, as related to area in California

This map and the two following were prepared for use in the present connection by Mr. Allen W. Jacobs under the direction of Mr. B. M. Varney, Instructor in Meteorology, University of California.

with the maps showing the distribution of the species of *Dipodomys* (figs. T, U, W, X), do give ground for a tentative generalization with regard to color.

First, as already set forth, there is general concordance in darkening of coloration from the interior toward the coast, throughout the

genus; and this parallels grossly the geographic behavior of all three of the climatic factors under consideration. When it comes to detail, the most close concordance will, I think, be observed to be with the chart showing percentage of cloudiness. The *heermanni* group offers the best cases of local correlation; note especially the west-east series,

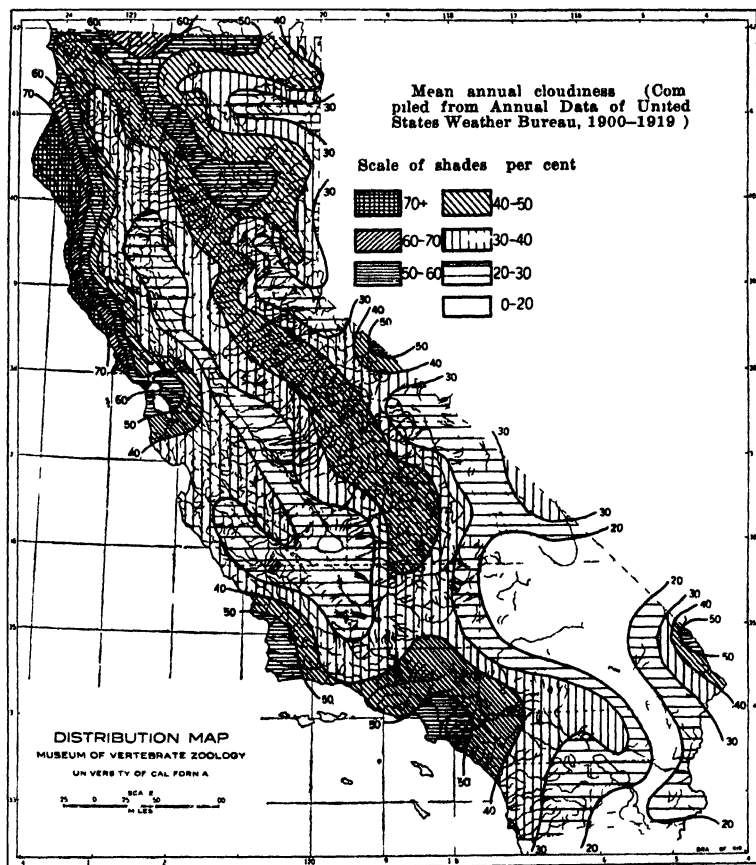


Fig. G. Map showing mean annual cloudiness as related to area in California.

from the exceedingly dark *morroensis* at Morro Bay through the pale *swarthi* and *mohavensis*.

Perhaps the best index in *Dipodomys* to degree of "darkness" or of "paleness," in other words to degree of pigmentation, is relative proportion of black and white striping on the tail. Figure E shows diagrammatically the condition in several different species, arranged from the foggy coast belt to the almost cloudless desert. It must be

understood that no such statistical mode of treatment has been applied in the present study as has been devised and put into practice by Dr. Francis B. Sumner (1918) in his admirably conducted investigation of the genus *Peromyscus*. Nevertheless, the kangaroo rats show

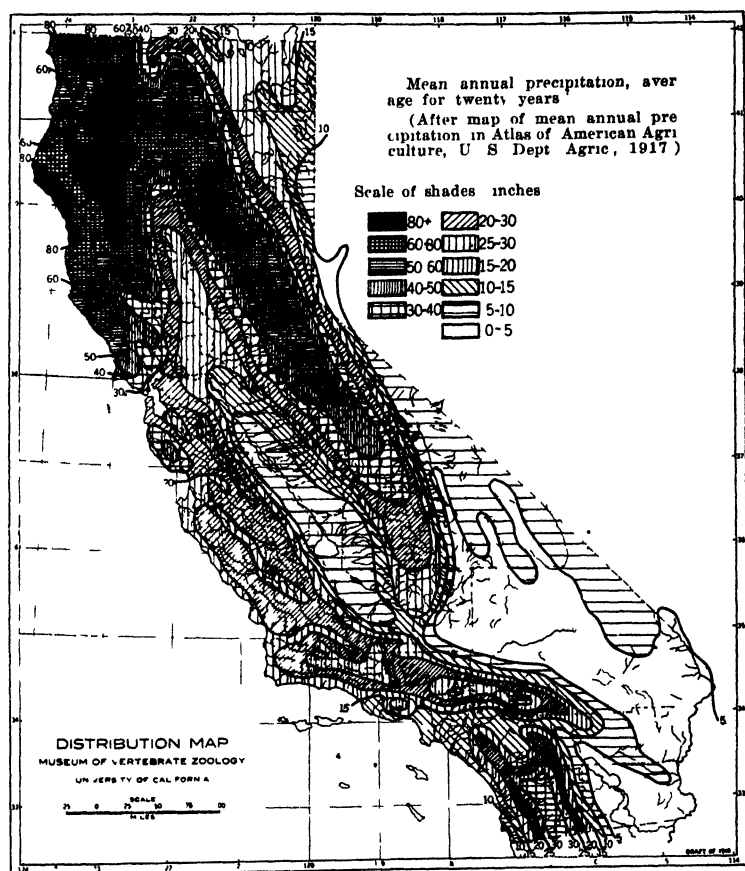


Fig H. Map showing mean annual rainfall as related to area in California.

in this feature of tail-stripping so wide a range of specific and sub-specific, as contrasted with individual, variation, that the grosser methods here employed cannot but indicate facts worthy of confidence.

It is suggested that the relative darkness or pallor of general coloration (and percentage of dark to white in the striping of the tail seems to constitute an index to this) may, through some sort of very slow



environmental action, reflect the light conditions of the region inhabited; and this may be usefully connected with the need of concealment against the mean tone of the background as observed from the viewpoint of the terrestrial or aerial enemy. The fact that *Dipodomys* is wholly nocturnal in its above-ground activity need not mitigate against this idea.

*General size.*—It is practicable to employ two indexes to general size of kangaroo rats, namely, length of head and body without tail, and weight of entire animal. Examination of the table (p. 36) will show very close correlation between these two indexes in so far as figures are available. Enough evidence has been accumulated to show that weights in this genus of rodents are little if any more variable individually than dimensions or proportions. *Dipodomys* is a non-aquatic, actively cursorial rodent, and one which, so far as known, at least everywhere in California, does not hibernate. Probably as a result of these circumstances it does not store up fat in the fall as do most other groups of rodents, and there is little variation in weight from season to season. In our field experience we do not recall having skinned out a really *fat* kangaroo rat.

Weight, then, is a good diagnostic character by the help of which to identify individual kangaroo rats as well as series of specimens, in the latter case, of course, by using averages. Our largest species, *ingens* (with estimated weight of 105 grams), is three times the size of our smallest species, *exilis* (with estimated weight of 34 grams). There is thus plenty of room for appreciable distinctions as between species of intervening size. In fact weights provide opportunity for drawing finer distinctions between species than do dimensions. For while the ratio of *ingens* to *exilis* by weight is 3 to 1, on basis of length of head and body the ratio is only about 3 to 2. The usual differential rate of progression obtains, as between volumetric and linear values.

It will be noted that in the *heermanni* group, *eximius* and *dixonii* are both of small size and of interior valley (and low adjacent foothill) habitat. In the *merriami* group, *exilis* is of smallest size and also of low valley habitat. Among series of near-related forms there are cases of decrease in size toward the south (in the *agilis* group, notably, for example). This may be causally the same as decrease of size with lowering altitude, as just noted. But exceptions to any rule suggested by these facts loom up. For example, *ingens*, of greatest size in the *heermanni* group, is of valley habitat!

It is of possible significance from the standpoint of compatibility of species, to note that where two or more congeneric species occur on

common ground they are usually of quite different sizes. For example, around the south end of Owens Lake there are *deserti*, *mohavensis*, and *merriami*, all on common territory; the weights of these species average 103, 76, and 40 grams, respectively. However, each of these belongs to a separate group, in other features than size differing

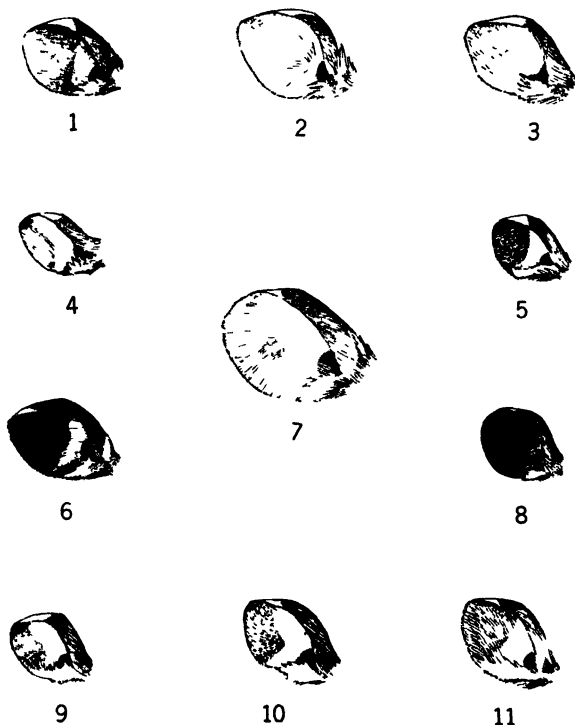


Fig. I. Ears of kangaroo rats to show size, and pattern of marking, in different species and subspecies. All  $\times 1$ .

1, *Dipodomys agilis agilis*, no. 5400, ♀; 2, *Dipodomys agilis perplexus*, no. 16141, ♀; 3, *Dipodomys agilis cabezonae*, no. 7363, ♂; 4, *Dipodomys microps*, no. 27013, ♀; 5, *Dipodomys levipes*, no. 26978, ♂; 6, *Dipodomys heermanni heermanni*, no. 18405, ♂; 7, *Dipodomys elephantinus*, no. 28520, ♂; 8, *Dipodomys morroensis*, no. 29031, ♀; 9, *Dipodomys mohavensis*, no. 26842, ♀; 10, *Dipodomys panamintinus*, no. 26862, ♀; 11, *Dipodomys heermanni swarthi*, no. 14448, ♂.

markedly. They are doubtless complementary rather than competitive, from an ecological standpoint. Diversity of size may become a factor of selectional value in the evolution of a group which as a whole has found a favorable ecologic niche of sufficient "amplitude" to be occupied by more than one species of that group.

*Size of ear.*—Great differences exist in the size of the ear between the different species of *Dipodomys* (see fig. I). By actual area, the

smallest ear (that of *exilis*) is to the largest ear (that of *elephantinus*) as 1 to  $4\frac{1}{5}$ . Direct comparisons had, of course, best be made between species of similar body size; for example, as between *tularensis* and *sanctiluciaae*, in which case we find an areal ratio of 2 to 3.

Consideration of habitats in connection with size of ear brings out unmistakably the correlation of small pinna with open type of habitat, and, in the other direction, of large pinna with a chaparral type of habitat. The same tendencies are to be observed in *Peromyscus* and *Perognathus*.

An interesting circumstance, however, with *Dipodomys* at least, is that, in many of the small-eared forms, the relative inflation of the mastoid and tympanic portions of the skull is far greater than in the large-eared forms. Increased effectiveness of the internal parts of the aural apparatus would here appear to be in some measure compensatory to the reduction of the external parts. The kangaroo rat with the greatest bullar inflations is *deserti*, and this species has small pinnae relatively to the gross size of the animal. A parallel is afforded in the *microps* group.

There are apparent outstanding exceptions to the above rule of compensation, however. In *mohavensis* there is both small ear and small bullae; and in *elephantinus* there is large ear in combination with large bullae. One can only suggest that several sorts of factors may enter the problem, such as amount of digging each species has to do to gain requisite safety (large external ears are certainly not an advantage to a fossorial animal), kind of soil which must be dealt with, requisite extent of forage radius, and kind of cover in connection especially with the mode of attack on the part of predatory enemies.

*Hind foot*.—Specific variations in respect to this member are pronounced. As to general proportions, the *merriami* group shows an extreme of slenderness, while the *heermanni* and *agilis* groups show an extreme of heaviness (that is, the foot is relatively broad). There is a fairly clear correlation here with existence on bare, open ground sparsely grown to vegetation, as compared with more or less grassy or bushy territory. The slender-footed *merriami* group is most abundant as to individuals on the most open ground. If "broad-footed" groups are represented in the same general vicinity, they will be found to predominate on ground of the opposite characteristic. Lesser and greater degree of development of the first toe, as discussed next, may be similarly linked with environment; but this correlation is not so clear, when we call to mind *deserti* with its rather heavy foot and vestigial first toe.

The hairiness of the hind foot is not altogether uniform among all the species. The sand-inhabiting *deserti* has notably heavy hairing on the sole, as also have *leucogenys* and *columbianus* of the marginal Great Basin area east of the main Sierras, where the snowfall is heavy.

*Toes and claws.*—There can be little doubt that the bi-pedal mode of locomotion in *Dipodomys* is making unnecessary the retention of

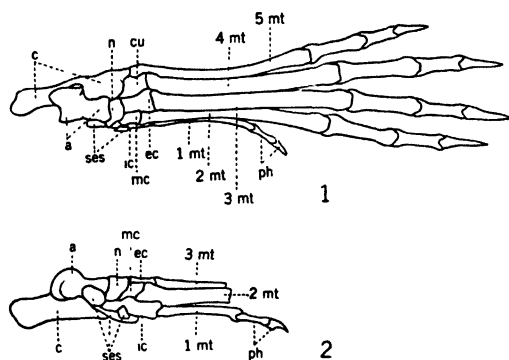


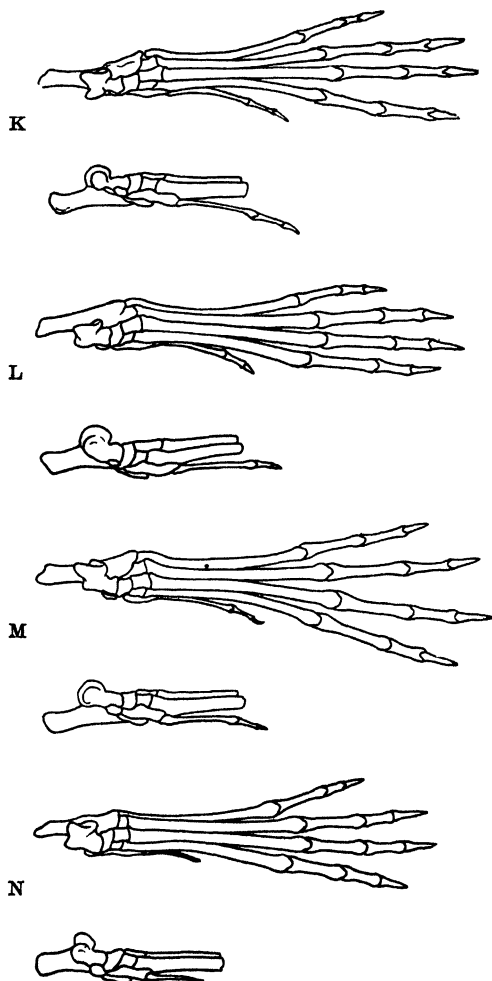
Fig. J. Bones of left hind foot of *Dipodomys ingens*, no. 16671, Mus. Vert. Zool.; 1, dorsal view; 2, inner lateral view.  $\times 1\frac{1}{2}$ .

Explanation: a, astragalus; c, calcaneum; n, navicular; cu, cuboid; ec, external cuneiform; mc, middle cuneiform; ic, internal cuneiform; ses, sesamoid bones; 1mt, 2mt, 3mt, 4mt, 5mt, first to fifth metatarsals; ph, the two phalanges of the first digit (pollex).

the full mammalian number of digits (see figs. J–P). Number 1 is first to be spared, and it is rudimentary at best; in fact, it is in actual process of disappearance. Number 5 is now decidedly smaller than the other three, though still a sizable structure, and will probably be next to fall out. Numbers 2, 3 and 4 are of unequal length; number 2 is slightly the shortest, number 4 next, and number 3 longest. The order of the hind toes in point of length, is then, from shortest to longest, 1–5–2–4–3.

The “groups” of kangaroo rats here recognized quite surely constitute, each one of them, an older divergence than any one of their component forms. It is quite clear that the progressive loss of the first digit on the hind foot is now going on independently in separate descent lines. In the *ordii* and *microps* groups the process of toe reduction is least advanced; in so far as material has been examined, in no individual is there a loss of even the terminal phalanx and its claw, even on one of the hind feet. In the *agilis* group, two of the constituent races show occasional individuals in which the claws or phalanges are absent on one or both of the first hind toes. In the

*heermanni* group, one race shows occasional lapses, and in two races (*californicus* and *eximius*) the claw and the phalanx which bears it is absent normally, though in one race it is present rarely on one or both hind feet (see figs. L to N). In the *merriami* and *deserti* groups the process of loss is complete to the extent that (constantly so far as



Figs. K to P. Bones of left hind foot in various kangaroo rats showing, especially, different degrees of reduction of the first toe. All  $\times 1\frac{1}{2}$ .

Fig. K. *Dipodomys elephantinus*, no. 28520, ♂.

Fig. L. *Dipodomys heermanni heermanni*, no. 18632, ♂.

Fig. M. *Dipodomys heermanni californicus*, no. 18672, ♀.

Fig. N. *Dipodomys heermanni californicus*, no. 18634, ♂.

examination has gone) only a rudiment of the first metatarsal is present (see figs. O, P). In other words, the same process which began in the two last named groups so long ago as to have brought an extreme in the reduction, constant at the present time, is now going on independently in the *heermanni* and *agilis* groups, and has not yet advanced to even this degree in the *ordii* and *microps* groups.

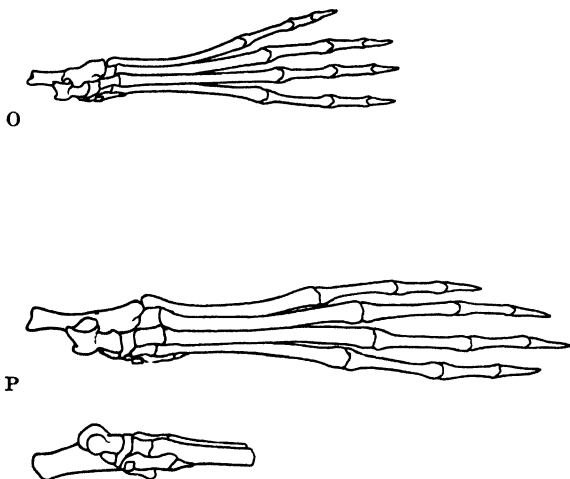


Fig. O. *Dipodomys merriami merriami*, no. 10323, ♂.

Fig. P. *Dipodomys deserti*, no. 10708, ♂.

The reduction of the toes is, then, a sort of orthogenetic tendency inherent in the group as a whole, but it is no less, in the writer's view, an adaptational process, brought about, or helped along, at least in part, through natural selection. The facts that the size of first claw varies to the point of being scarcely discernible externally and that the individuals that have been dissected show variations in the degree of diminishment of the supporting bones, all go to show that the process of toe reduction is an exceedingly gradual one, not one involving any abrupt "mutation" of perceptible magnitude.

Digital reduction, by whatever method it is being effected, is undoubtedly improving the cursorial powers of *Dipodomys*, with the result that forage area of individuals is enlarged while at the same time relative safety from swift-footed enemies is retained or even enhanced.

*Relative length and thickness of tail.*—In all the kangaroo rats, when compared with most rodents, the tail is long and rather heavy.

As may be figured from the table of measurements (p. 36), the average ratio of tail to body in the 33 Californian forms is 145 per cent. But there is variation from species to species as well as, of course, in much lesser amount, individually. The two extremes in the averages are 116 per cent and 167 per cent, for *monoensis* and *californicus*, respectively. By groups, the *ordii* group shows the shortest tail of all, namely, an average of 121 per cent; next comes the *microps* group, 135 per cent; then the *merriami* and *deserti* groups, both 143 per cent; then the *heermanni* group, 148 per cent; and last the *agilis* group, 155 per cent. The *heermanni* group exhibits the greatest range in specific variation, from 128 per cent (in *ingens*) to 167 per cent (in *californicus*).

As to heaviness, or better, thickness, of tail, superficial examination at once reveals some outstanding conditions. Either member of the *microps* group can be told from any member of the *merriami* group by much greater thickness of the tail, even though the animals concerned may be of about the same general size. In fact, this is a practical means of telling apart freshly caught individuals of these two groups in the field. Unfortunately, actual measurements in this respect, from fresh specimens, are not available at this writing. The same criterion seems to hold, though to a lesser degree, as between the *ordii* group and the *merriami* group. *Merriami* apparently exhibits the slender extreme in the genus, while the opposite obtains in *ingens*, which shows the thickest tail both actually and relatively to length of tail.

In so far as the writer can see there is no significant correlation between either length or slenderness of tail with size of hind foot, with presence or absence of first claw on hind foot, with size of ear, or with geographic distribution.

Hairiness of tail varies specifically, most especially with regard to the terminal tuft and the dorsal "crest" leading forward from the tuft. The maximum development of the tail tuft is shown in the northern members of the *agilis* group, to greatest degree, perhaps, in *elephantinus*; while the least is shown in the coastal members of the *heermanni* group, *goldmani* and *morroensis*. No correlation with kind of habitat is obvious.

*Cranial features.*—A selected, dry, cleaned skull, without mandibles, of *deserti* weighs 2.1 grams; the same of *exilis*, 0.3 grams. The skull of *exilis*, our smallest species, is thus but one-seventh in mass that of *deserti*, our largest. So wide a latitude in size of skull

is unknown in any other rodent genus represented in California except *Thomomys*. Comparative dimensions of skulls therefore become of extraordinary importance in defining the species of *Dipodomys*.

The proportions of certain parts of the skull also vary so as to furnish many characters of good diagnostic value (see pls. 3 to 6). The whole skull may be relatively broad, as in *ingens*, or it may be narrow, as in *elephantinus*, and of course the frontal and other bones

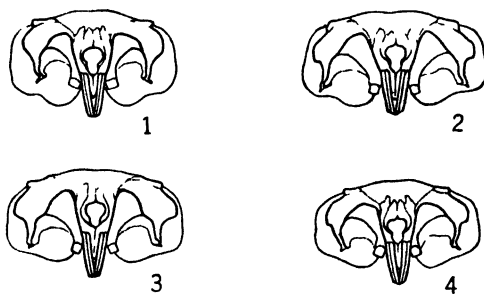


Fig. Q. Skulls of kangaroo rats as viewed from directly in front, to show "narrow faced" versus "broad-faced" types. All  $\times 1$ .

Narrow-faced, with narrowly spreading and weakly angled maxillary arches: 1, *Dipodomys agilis agilis*, no. 5394, ♂, and 4, *Dipodomys levipes*, no. 26968, ♂. Broad faced, with widely spreading and prominently angled maxillary arches: 2, *Dipodomys heermanni jolonensis*, no. 29088, ♀; 3, *Dipodomys stephensi*, no. 2477, ♂.

contributing to the breadth of the skull will show similar proportions. The rostrum may be rather heavy, and even flaring at the end, as in *elephantinus*, or it may be very slender, as in the *merriami* group; and the nasals and premaxillary tongues show corresponding modifications. The actual length of nasals constitutes a good character in some species and subspecies.

The slenderness of the jugals is a marked feature of all kangaroo rats; nevertheless there is greater and less degree of slenderness among the different species. For example, in *deserti* the jugal bar is fully twice the width that it is in *levipes*. Also the position of the two jugal bars, whether or not they show in dorsal view of the skull well apart from the supra-orbital edges of the brain-case, varies. In the *agilis* group they are conspicuously outstanding, and bow outwards; in the *merriami* group they lie relatively much closer in beneath the orbit.

The zygomatic process of the maxilla, or simply "maxillary arch," is in all kangaroo rats a conspicuously outstanding cranial structure bounding the orbit in front (see figs. D, Q, R). There are two general



conditions of the skull in this regard, however, referred to as broad-faced and narrow-faced, respectively. In the former the two maxillary arches are wide, they are spread apart from the axis of the skull broadly, and the postero-external angle of each is prominent; in the opposite, "narrow-faced," type the maxillary arches are narrow, less widely spreading, and the postero-external angles are weakly developed (see pls. 3 to 6). While there are different degrees of development of these characters among the species within any single group, it may be said with fair accuracy that the *heermanni*, *ordii*,

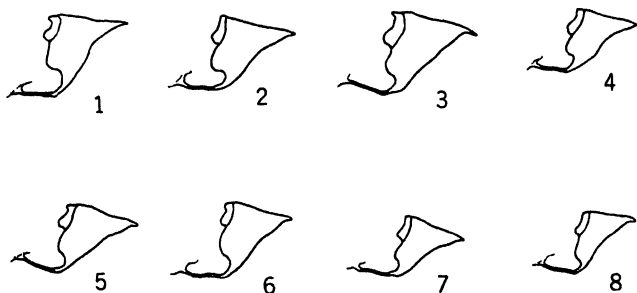


Fig. R. Maxillary arches, in outline as viewed laterally, of different species and subspecies of kangaroo rats. All  $\times 1$ . Upper row, of broad-faced type, with arch wide and angle prominent; lower row, of narrow-faced type, with arch narrow and angle weak.

1, *Dipodomys heermanni heermanni*, no. 18408, ♀; 2, *Dipodomys panamintinus*, no. 26889, ♂; 3, *Dipodomys ingens*, no. 14447, ♂; 4, *Dipodomys ordii monoensis*, no. 26999, ♀; 5, *Dipodomys agilis agilis*, no. 5394, ♂; 6, *Dipodomys venustus sanctiluciae*, no. 14446, ♀; 7, *Dipodomys levipes*, no. 26937, ♂; 8, *Dipodomys microps*, no. 27021, ♂.

and *merriami* groups possess the broad-faced type of skull and the *agilis*, *microps*, and *deserti* groups possess the narrow-faced type of skull.

Degree of "inflation" of the tympanic and mastoid bullae is a greatly varying feature in the genus *Dipodomys*. The inflated mastoid is particularly sensitive, it would seem, to differences of environment; and there will often be found notable differences in volume or outline of this part of the skull in closely contiguous, and otherwise very closely similar, species or subspecies. In a general way, increased inflation of the mastoid region is accompanied by a narrowing of the elements lying between, namely, the interparietal and supraoccipital. But, as noted under *californicus* (p. 39), there is not the perfect correlation in this regard that might be expected.

As far as can now be seen, there is no correlation of general size of skull with any of these proportional features, nor of narrow-faced

condition (versus broad-faced) with slenderness of rostrum or with bullar inflation. Neither is there correlation of any of the cranial features with degree of toe-reduction. These facts militate against any hope of subdividing the genus *Dipodomys* on "natural" grounds.

*Teeth.*—The teeth in *Dipodomys*, so far as study of them has been carried by the writer, are structurally so uniform in all respects, at least among the Californian species, as to afford very few specific characters. Actual size of teeth varies directly with the size of the animal. The simple molariform series has revealed no usable characters whatsoever; but the upper incisors vary somewhat in relative shortness, and especially in curvature. In the latter regard the majority of the species have the exposed portions of these teeth strongly in-curved antero-posteriorly; but in the *microps* group, notably, the upper incisors are much more nearly vertical as viewed from the side.

### DISTRIBUTIONAL CONSIDERATIONS

A reasonable presumption, one suggested by the work of several zoogeographers, is that the center of differentiation as well as of dispersal of the *Dipodomys* stock lay in northern Mexico. Thence, one or some of the outwardly spreading descent lines extended towards California, as permitted by the mitigation of such barriers as more or less impeded the emigration of mammals of this type. The more important of these barriers were doubtless those of climate. Some degree of adaptation to different grades of these climatic conditions (temperature and humidity) was doubtless acquired by the invading stock or stocks, and differentiations into the initial races probably occurred, these races later, as they began to be accentuated into full species, themselves giving rise to subspecies, and this process continuing until the present-day situation was reached.

It would seem that a study of the barriers which appear to be effective at the present time in limiting the ranges of the species and subspecies in *Dipodomys* would afford a key to the explanation of their origin and interrelations.

*Limitation by water.*—The most obvious barrier for kangaroo rats to the westward is the Pacific Ocean. As a matter of fact, there are usually associational barriers which more or less limit these animals short of the seabeach itself. Only *Dipodomys morroensis* and *Dipodomys heermanni goldmani*, at Morro and Monterey bays, respectively, reach clear to the edge of the belt of fresh, shifting sand dunes lying just back of the beach proper.

Kangaroo rats, as determined by both observation and experimentation upon certain desert species, are averse to water. They even lack the ability to swim. When tossed into a pond of water a perfectly healthy individual will merely kick out behind a few times, with both feet at once, and, after a few spasmodic efforts, soon drown. The pelage is of such a quality that it soaks up water quickly, instead of shedding it, as with meadow mice and harvest mice; so that the animal quickly becomes water-logged.

A complete water barrier is exemplified in the Golden Gate, continued eastward by San Francisco and San Pablo bays, the Strait of Carquinez, and Suisun Bay. On the north of this deep and permanent channel we find *Dipodomys heermanni californicus*, on the south side are *D. heermanni berkeleyensis* and *D. venustus venustus*. It is to be remarked that *berkeleyensis* and *californicus* are to each other, across this barrier, as perfectly distinct species; there is no chance of direct intergradation. The subspecific status indicated in the trinomial is due to *roundabout* intergradation—from *berkeleyensis* through *tularensis*, *heermanni*, and *eximius*, to *californicus* (see map, fig. T). In the writer's view such extreme differentiation as obtains between *berkeleyensis* and *californicus* could not have taken place except for the agency of an absolute barrier to intercrossing, such as has been comprised in San Francisco Bay and its approaches.

*Venustus* belongs to a totally different "group" of kangaroo rats from *berkeleyensis* and *californicus*, namely, the *agilis* group. And the Golden Gate forms at the present day the northward limiting barrier to both the species, *venustus*, and its group. It may be inferred that the ancestral stock of *venustus* moved up toward the Golden Gate from the south *since* that barrier was established by the piercing of that spillway from the Sacramento-San Joaquin drainage, as a result of general land depression in the Bay region. It is surmisable, moreover, that the *venustus* stock did not get north, even into the Santa Cruz subfaunal district, until after the closure of the pre-existing Sacramento River outlet into Monterey Bay.

It is, of course, possible that the ancestral stock of the *heermanni* group reached into the San Francisco Bay region from the southeastern interior, moving westward as well as northward, after the Golden Gate was pierced, and that *californicus* has reached the Bay from the north, and *berkeleyensis* has reached it from the south, much more recently. However this may be, it is here contended that this water barrier has functioned to keep the descent lines apart and thus

has permitted much greater divergence than would otherwise have taken place.

Other places in California where water barriers are believed to have helped to establish boundaries between potential differentiation centers are as follows: the Sacramento River and its paralleling over-flow tracts, between *californicus* and *eximius*; the lower San Joaquin River between *dixonii* and the northwestern arm of the range of *tularensis* (see map, fig. T); and the Kings River as cutting off *exilis* from *nitratooides* and *brevinasus* (see map, fig. U).

As elsewhere shown (Grinnell, 1914, pp. 100-107, 240-243) the Colorado River is evidently not the barrier to *Dipodomys* that, in view of the aversion of this animal to water, it might be, for two reasons: first, both *D. deserti* and *D. merriami*, the species occurring along the lower Colorado, have been ascertained to exist regularly on the "second bottom," and individuals doubtless occasionally forage thence out into the "first bottom"; secondly, at least these latter individuals are then subject to being cut off from access to the one side of the river and to being given access to the opposite side. Such a process of transfer of tracts of bottom land from one side to the other, as channels shift, is of common occurrence along parts of this river's course, particularly at times of rapid rising and lowering of the water.

No *Dipodomys* whatever is known from any of the coastal islands, not even from Santa Catalina and Santa Cruz, the most likely ones. It is to be inferred that representatives have never reached the islands by any fortuitous agency, or that having reached the islands such pioneers were unable to establish successful colonies there. Or else, in event of kangaroo rats having been a part of the initial fauna existent on the islands immediately after the latter were disconnected from the Californian mainland and from one another, they have been exterminated. Continuity of distribution might well have obtained over the whole early Pleistocene territory involving both the site of the islands and the mainland, for all that we know of the geological history of the region. After sequestration on the portions of the land cut off through subsidence, the separate colonies of kangaroo rats would have at once encountered an adverse factor in the reduction of their habitats, this being accentuated by the close associational restriction of these animals. The smaller the area available to a species, the greater the chance for complete extinction from such causes as recurring periods of extreme food shortage, epidemic disease, and extreme weather conditions. (See Grinnell and Swarth, 1913, p. 385.)

*Limitation by life-zones.*—The genus *Dipodomys* is emphatically Austral in its life-zonal occurrence. The situation in California is shown graphically in the accompanying table (fig. S). It will be observed that the *deserti* and *merriami* groups are exclusively Lower Sonoran; the *microps* group is also Lower Sonoran, but rather more toward its upper portion; the *ordi* and *agilis* groups are essentially Upper Sonoran; while the *heermanni* group contains some species (seven of them) which belong to the Lower Sonoran zone and others (eight of them) which belong to the Upper Sonoran zone. The *agilis* and *heermanni* groups contain species which extend well into the Transition zone; but in each of these cases the metropolis is in the

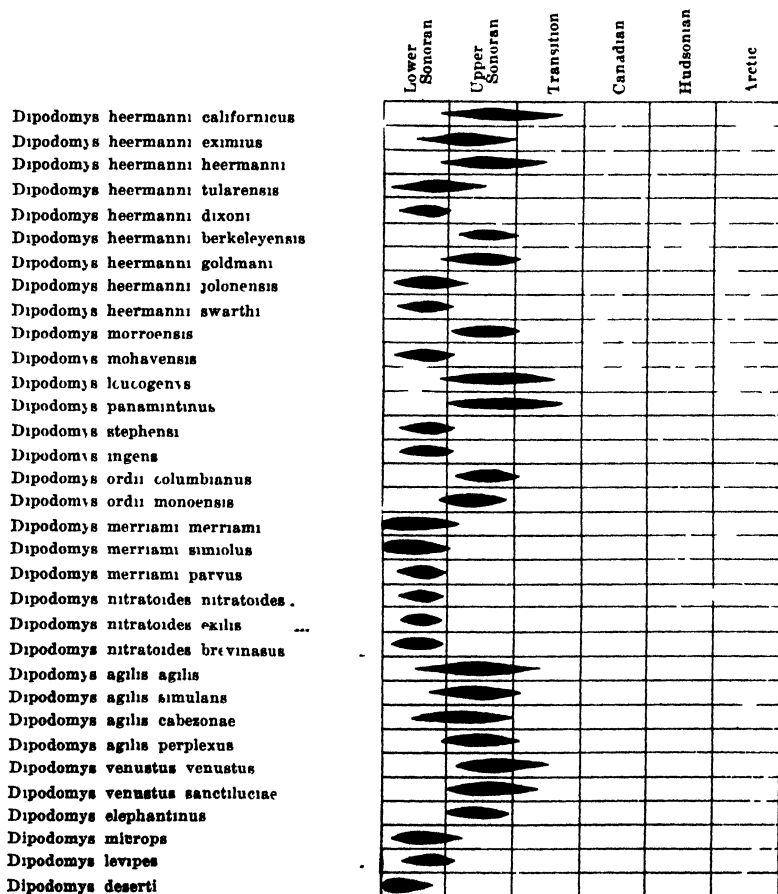


Fig. S. Table showing distribution of the forms of *Dipodomys* in California by life-zones.

Upper Sonoran. No species whatsoever occurs in equal numbers in two zones. In other words, every species of *Dipodomys* in California has its center of abundance in either the Lower Sonoran life-zone or else in the Upper Sonoran; there are sixteen species in the former and seventeen in the latter.

The factor of temperature, in climate, thus now, as probably always, acts importantly with *Dipodomys* as a barrier and hence importantly in the general process of differential evolution.

*Limitation by the factor of humidity.*—There is no question that kangaroo rats as a group are adapted in conspicuous ways to an arid environment, and that the general limits of areas characterized by conditions of dryness constitute also the limits of distribution of these animals, irrespective of the water barrier and of mean summer temperature below some critical point. To pick out of the general condition, "aridity," any one of the several minor factors is, however, a difficult, perhaps impossible, matter. Relative humidity of the air, rainfall, percentage of cloudiness, degree of wetness of the soil, may function, any single one of them with dominant importance, or all of them in varying proportion.

A complication arises, in determining between major factors, in the matter of soil moisture. The very limited power of digging in the kangaroo rats, combined with the necessity in most species for *some* digging, limits the animals to areas containing tracts of loose soil such as is as a rule associated with lack of rainfall. Wind-accumulated sands constitute the preferred sort of ground for burrows in the majority of the species. That cloudiness, high percentage of atmospheric humidity, and even moderately heavy rainfall are not per se inimical to the existence of *Dipodomys*, if the soil be of proper texture, is shown by the fact that a large population occurs, locally, in the southern end of the humid coast belt of California, near the shores of Morro and Monterey bays. The species there represented (*morroensis* and *goldmani*) do, however, show adaptations to the special climatic conditions named—in different quality of pelage and much darker coloration as compared with species and subspecies in the same group from dryer, interior areas. These characters, developed through time secondarily in response to humid conditions, themselves probably impose limitations on the spread of the species possessing them, back toward the interior.

That *venustus* and *californicus* exist regularly in still more humid districts will be apparent from the lists of record stations for these forms. These races do not approach so near to the actual seacoast

as the ones just previously named, but they penetrate the "humid coast belt" farther north where the conditions are more extreme. The cases are quite parallel. Geographic limitation in such instances as these may, therefore, be brought about by the condition, say, of atmospheric humidity, or that of color-tone of background.

In the writer's estimate, as regards the species and subspecies of kangaroo rats in California, humidity is of minor importance as a barrier to extension of range as compared with unfavorable temperature and bodies or streams of water.

### ARTIFICIAL KEY TO ADULT KANGAROO RATS OF CALIFORNIA

NOTE.—To use this Key with promise of success, the student should have before him not only either fresh animals or well-made skins with carefully taken measurements, but also well-cleaned skulls; and he should further have at hand Ridgway's Color Standards (1912) and a pair of calipers reading to tenths of millimeters. Even so, this Key will likely fail for specimens in worn and faded or discolored condition of pelage; then detailed study will have to be made of all the descriptions and illustrations.

PAGE

1. Size very large: length of head and body usually more than 130 mm.; hind foot usually more than 49; breadth of skull across bullae more than 27.5.
2. No ventral dark tail-stripe; end of tail pure white; width of maxillary arch at middle less than 5 mm.; no first toe on hind foot **deserti** 106
- 2'. Ventral tail-stripe present, well defined, blackish; end of tail drab or dusky; width of maxillary arch at middle more than 5 mm.; first toe on hind foot present **ingens** 67
- 1'. Size moderately large to small: length of head and body usually less than 130 mm.; hind foot usually less than 49; breadth of skull across bullae less than 27.5.
3. Width of maxillary arch at middle less than 3.9 mm.
4. Size small: greatest length of skull less than 36.6 mm.; breadth of skull across bullae less than 23.3 **microps** 102
- 4'. Size medium: greatest length of skull more than 36.6 mm.; breadth of skull across bullae more than 23.3 **levipes** 104
- 3'. Width of maxillary arch at middle more than 3.9 mm.
5. Size moderate: total length more than 265 mm.; hind foot usually more than 40.
6. Ear large, usually over 15 mm. in height from crown.
7. Coloration darker: dorsal tone close to cinnamon-brown; ear mostly blackish; dark ventral tail-stripe halfway toward end wider than lateral white stripe.
8. Slightly paler: dorsum light cinnamon-brown; many white hairs on inner surface of pinna; bullae larger **sanctiluciae** 99

	PAGE
8'. Slightly darker: dorsum deep cinnamon-brown; few white hairs on inner surface of pinna; bullae smaller	<b>venustus</b> 98
7'. Coloration lighter: dorsal tone close to cinnamon-buff; ear mostly brownish; dark ventral tail-stripe half way toward end narrower than lateral white stripe.	
9. Larger: total length usually more than 315 mm.; ear more than 16; hind foot usually more than 45.5; nasals flaring at ends.	<b>elephantinus</b> 101
9'. Smaller: total length usually less than 315 mm.; ear less than 16; hind foot usually less than 45.5; nasals not flaring at ends	<b>perplexus</b> 96
6'. Ear medium to small, less than 15 mm. in height from crown.	
10. No first claw on hind foot (normally).	
11. Larger: total length usually more than 300 mm.; ear more than 13; hind foot usually more than 43	<b>californicus</b> 37
11'. Smaller: total length usually less than 300 mm.; ear usually less than 13; hind foot usually less than 43	<b>eximius</b> 41
10'. First claw on hind foot present (normally)	
12. Coloration relatively dark; facial arietiform marking bold, black, complete; dorsal dark tail-stripe usually at least twice width of lateral white stripe.	
13. White flank stripe incomplete, or absent altogether.	<b>morroensis</b> 58
13'. White flank stripe always present, complete.	
14. Dorsal dark tail-stripe more or less grizzled; dorsal body-color paler, near warm buff; bullae more inflated: breadth of skull across bullae usually more than 25 mm	<b>jolonensis</b> 55
14'. Dorsal tail-stripe solidly black or blackish; dorsal body-color darker, cinnamon-buff or darker; bullae less inflated. breadth of skull across bullae usually less than 25 mm.	
15. Nasals short, less than 14 mm. long; bullae smaller: breadth of skull across bullae usually less than 23.6.	<b>dixonii</b> 50
15'. Nasals longer, more than 14 mm. long; bullae larger: breadth of skull across bullae usually more than 23.6.	
16. Skull of "narrow-faced" type: maxillary arches weakly angled and their spread less than 22 mm.	
17. Lighter colored: dorsum dusky cinnamon-buff; bullae smaller: breadth of skull across bullae usually less than 24.5 mm.	<b>agilis</b> 87
17'. Darker colored: dorsum near dusky pinkish cinnamon; bullae larger: breadth of skull across bullae usually more than 24.5 mm	<b>simulans</b> 93



	PAGE
16'. Skull of "broad-faced" type: maxillary arches prominently angled and their spread more than 22 mm.	
18. Tail weakly crested and tufted: terminal hairs usually less than 20 mm. long	53
18'. Tail more heavily crested and tufted: terminal hairs usually more than 20 mm. long.	
19. Bullae less inflated: breadth of skull across bullae less than 24.3 mm	51
19'. Bullae more inflated: breadth of skull across bullae usually more than 24.3 mm.	
20. Ear larger, more than 12.8 mm. in height from crown; bullae as viewed from above not globular in outline	43
20'. Ear smaller, less than 12.8 mm. in height from crown; bullae as viewed from above approaching globular, that is, all parts of outline more curved	65
12'. Coloration of medium tone or pale; facial arietiform marking weak or else, even, broken (so that dusky patches at bases of whiskers are not continuous with dusky top of nose); dorsal dark tail-stripe not as much as twice width of lateral white stripe.	
21. Skull of "narrow-faced" type: maxillary arches weakly angled and their spread usually less than 22 mm.	95
21'. Skull of "broad-faced" type: maxillary arches prominently angled and their spread more than 22 mm.	
22. Color tone of dorsum paler, near ochraceous-buff; ear smaller, less than 12 mm. in height from crown.	
23. Bullae smaller: breadth of skull across bullae less than 24.9 mm.	60
23'. Bullae larger: breadth of skull across bullae more than 24.9 mm.	56
22'. Color tone of dorsum darker, near warm buff, pinkish buff or cinnamon-buff; ear larger, more than 12 mm. in height from crown.	
24. Bullae larger; narrowest place between mastoid bullae as looked at dorsally, less than 2 mm. wide; rostrum near end usually less than 4.1 wide.	47
24'. Bullae smaller; narrowest place between mastoid bullae as looked at dorsally, more than 2 mm. wide; rostrum near end usually more than 4.1 wide.	
25. Darker colored; white on ear as viewed in normal position restricted to extreme tip of upper fold-over	63

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25'. Lighter colored; white on ear continuous along whole rim of upper fold-over, leaving dusky restricted to a small interior tract toward base.	
<b>leucogenys</b>	62
5'. Size small: total length less than 265 mm.; hind foot usually less than 40.	
26. No first claw on hind foot.	
27. Ear flesh-colored all over; arietiform facial marking indistinct or wanting; ventral dark tail-stripe indistinct, narrower, usually less than 2.2 mm. wide halfway toward end.	
28. Darker and larger: dorsal color light ochraceous-buff with dusky overwash; length of head and body usually more than 100 mm.	
<b>merriami</b>	73
28'. Paler and smaller: dorsal color clear light ochraceous-buff; length of head and body usually less than 100 mm.	
<b>simiolus</b>	79
27'. Ear dusky, with tip of fold-over whitish; arietiform facial marking distinct, dusky; ventral tail-stripe distinct, hair brown to blackish, broader, usually more than 2.2 mm wide halfway toward end	
29. Size very small total length usually less than 230 mm.; hind foot 34 or less	
<b>exilis</b>	84
29'. Size larger: total length usually more than 230 mm.; hind foot usually more than 34.	
30. Facial arietiform marking weaker, tending to pinch out on each side between whisker patch and nose; rostrum of skull broader at base	
<b>parvus</b>	81
30'. Facial arietiform marking bold clear across nose, from one whisker patch to the other; rostrum of skull narrower at base.	
31. Darker and smaller: dorsal color dusky ochraceous-buff; length of head and body usually less than 99 mm.; bullae smaller: breadth of skull across bullae usually less than 22.2	
<b>nitratoides</b>	82
31'. Paler and larger: dorsal color clear ochraceous-buff; length of head and body usually more than 99 mm.; bullae larger: breadth of skull across bullae usually more than 22.2	
<b>brevinasus</b>	85
26'. First claw on hind foot present.	
32. Darker: dorsal color tone cinnamon-buff; facial arietiform marking distinct, dusky; ventral dark tail-stripe distinct, at least as wide as lateral white tail-stripe; greatest length of skull usually less than 36 mm	
<b>columbianus</b>	70
32'. Paler: dorsal color tone pinkish buff; facial arietiform marking faint or wanting; ventral tail-stripe indistinct, pale mouse gray, narrower than lateral white tail-stripe; greatest length of skull usually more than 36 mm	
<b>monoensis</b>	71

## TABLE OF MEASUREMENTS

## AVERAGE MEASUREMENTS OF THE CALIFORNIA FORMS OF DIPODOMYS

Arranged in Sequence from Small to Large on Basis of Length of Head and Body  
Without Tail

Measurements in millimeters, weights in grams

	Number of specimens	Total length	Tail vertebrae	Length of head and body alone	Ratio, tail to body	Hind foot	Ear, from crown	Greatest length of skull	Breadth of skull across bullae	Spread of max- illary arches	Greatest length of nasals	Greatest width of zygomatic arch near end	Width of max- illary arch at middle	Weight	(Number weighed)
D n exilis	3♂♂, 1♀	216	128	88	145%	33 0	8 5	31 3	20 2	17 4	10 8	2 8	4 3	34 0*	
D n nitratoides	5♂♂, 5♀♀	233	139	94	148%	35 0	9 8	33 6	21 9	18 7	12 0	3 0	4 7	36 6	(10)
D m umiolus	5♂♂, 5♀♀	240	145	95	153%	37 5	10 5	35 4	22 3	18 7	12 9	3 0	4 8	38 0*	
D m parvus	5♂♂, 5♀♀	232	136	96	142%	36 0	10 0	34 5	22 0	19 3	12 9	3 0	5 1	36 0	(2)
D n brevinaeus	5♂♂, 5♀♀	237	135	102	132%	35 4	10 8	34 4	22 5	19 2	12 1	3 0	4 7	43 9	(10)
D o columbianus	5♂♂, 3♀♀	233	130	103	126%	38 0	10 0	35 6	22 5	19 3	13 1	3 4	4 0	44 0*	
D m merriami	5♂♂, 5♀♀	247	144	103	140%	38 5	11 0	35 7	23 0	19 2	13 1	3 0	4 9	40 3	(10)
D o monensis	5♂♂, 5♀♀	233	125	108	116%	38 7	11 0	36 9	23 3	19 9	13 7	3 5	4 3	45 8	(10)
D microps	5♂♂, 5♀♀	261	150	111	135%	41 0	10 0	35 2	22 4	18 9	12 3	3 4	3 4	63 5	(3)
D a cabersonae	7♂♂, 3♀♀	283	171	112	153%	43 0	13 4	39 5	24 5	20 8	14 2	4 0	4 8	61 0*	
D a simulans	6♂♂, 4♀♀	285	173	112	154%	42 0	13 0	38 8	24 7	20 3	13 9	3 8	4 7	61 0*	
D h eximius	5♂♂, 5♀♀	287	175	112	156%	41 6	12 5	36 6	22 6	21 6	13 7	3 9	4 9	60 5	(2)
D h dixonii	6♂♂, 4♀♀	283	170	113	150%	41 1	14 1	37 0	23 2	21 0	13 2	3 6	4 8	61 4	(8)
D h goldmani	5♂♂, 5♀♀	291	178	113	157%	42 2	13 3	39 3	24 1	22 3	14 4	3 8	5 1	68 1	(10)
D h heermanni	5♂♂, 5♀♀	293	180	113	159%	43 0	13 0	39 9	24 7	22 6	14 5	4 0	5 1	70 2	(4)
D a agilis	5♂♂, 5♀♀	293	179	114	157%	43 0	13 4	39 5	24 1	21 1	14 3	4 1	4 9	56 1	(10)
D h jolonensis	5♂♂, 5♀♀	304	188	116	162%	43 6	14 1	41 6	25 5	22 9	14 9	4 3	5 3	87 7	(10)
D h californicus	5♂♂, 5♀♀	312	195	117	167%	44 8	14 7	39 2	23 8	22 3	14 6	3 8	5 3	75 0*	
D levipes	5♂♂, 5♀♀	276	158	118	134%	42 0	11 0	37 8	24 0	19 9	13 2	3 8	3 6	71 3	(10)
D stephensi	9♂♂, 1♀	291	172	119	145%	42 0	12 0	39 4	25 1	22 5	14 2	4 0	5 6	74 0*	
D h tularensis	5♂♂, 5♀♀	294	175	119	147%	41 5	12 6	39 8	25 1	22 4	14 5	3 9	5 0	73 4	(10)
D a perplexus	5♂♂, 5♀♀	303	184	119	155%	44 2	15 4	41 0	25 1	22 4	15 3	4 3	4 9	73 5	(2)
D morroensis	5♂♂, 5♀♀	296	176	120	147%	42 6	13 5	38 9	23 4	21 9	14 4	4 0	5 1	68 0	(10)
D h berkeleyensis	1♂, 1♀	301	180	121	149%	41 0	12 0	39 2	23 9	22 5	14 6	4 4	5 0	71 1	(2)
D v sanctiluciae	2♂♂, 4♀♀	302	181	121	150%	45 0	16 0	41 9	25 4	22 0	15 6	4 2	5 1	84 8	(2)
D h swarthi	2♂♂, 4♀♀	297	175	122	143%	43 5	11 0	41 1	25 8	23 0	15 0	4 1	5 1	87 0	(2)
D v venustus	6♂♂, 2♀♀	316	194	122	159%	46 0	15 5	41 6	25 2	22 3	15 6	4 4	5 3	80 0*	
D mohavensis	5♂♂, 5♀♀	290	167	123	135%	43 7	10 3	39 3	23 9	23 2	14 8	3 9	5 5	75 8	(10)
D leucogenys	5♂♂, 5♀♀	301	176	125	141%	45 2	12 4	40 4	24 3	23 2	15 4	4 4	5 4	80 0	(10)
D panamintinus	5♂♂, 5♀♀	299	173	126	137%	44 4	13 6	40 5	24 8	23 6	15 4	4 2	5 7	79 1	(10)
D elephantinus	5♂♂, 5♀♀	324	197	127	155%	46 8	17 4	43 0	26 3	23 0	15 7	4 9	5 2	85 2	(10)
D deserti	5♂♂, 5♀♀	342	201	141	143%	53 0	13 5	45 6	30 7	23 6	16 6	4 1	4 4	103 3	(10)
D ingens	2♂♂, 6♀♀	329	185	144	128%	50 0	13 0	44 6	29 0	26 5	16 5	4 9	5 9	105 0*	

\*Estimated.

**Dipodomys heermanni californicus Merriam**

## Northern California Kangaroo Rat

(PL 1, fig. 1; pl. 3, fig. 11; text-figs. M, N, S, T)

*Dipodomys Phillippii*, Leconte (1853, p. 224), part (†); and, at least in part, of several other early authors.

*Dipodomys phillipsi*, Coues (1875, pp. 322, 325-326), part; and, in part, of some other authors.

*Dipodomys californicus* Merriam (1890b, p. 49) [orig. descr.]; and of subsequent authors, at least in part.

*Dipodomys californicus pallidulus* Bangs (1899, pp. 65-66) [orig. descr.]; and of subsequent authors.

*Dipodomys californicus californicus*, Miller (1912, p. 276); and of some other authors.

*Dipodomys californicus trinitatis* Kellogg (1916, pp. 366-367) [orig. descr.].

**Diagnosis.**—A middle-sized, broad-faced, usually four-toed, kangaroo rat, of very dark style of coloration; dorsal and ventral tail stripes broad and black and meeting in a subterminal black zone, but end of tail abruptly pure white; ear of moderately large size (about 14.7 millimeters in height from crown); skull with small bullae, very broad interparietal and supra-occipital, heavy incisors, rather heavy rostrum, and widely spreading maxillary arches, with postero-external angles prominent. [For definite quantitative information in respect to most of the characters above and hereinafter commented upon, see the table of comparative measurements (p. 36), and the various plates and figures illustrating the species it is wished to compare.]

**Coloration.**—Pelage and coloration of pelage as described for *agilis* (which see, p. 87), except as follows. General color tone of upper surface of body slightly darker than in *agilis*, this darkness being due to the appreciably deeper tone of the cinnamon-buff element (tending towards clay color) as also to the slate-gray basal portions of the pelage, which show through more or less, being darker, more nearly slate color. The facial dark markings of *californicus* are bolder than in *agilis*, almost exactly as in *renustus*, and there is a little more black on the ankles. The hairing and coloration of the tail in *californicus* seem to be the same as in *agilis*, except for the white tip of the tail of the former species, this involving from 30 to 45 millimeters of the terminal tuft. The blackish dorsal and ventral tail stripes gradually meet to form a complete dark zone for 20 to 30 millimeters preceding the white tip.

**Variation in color.**—The molts and intervening pelages in *californicus* are as in *agilis*, as far as is now seen. Specimens in various stages of the single annual molt date from July 31 to November 7, the latter date being exceptionally late. There seems to be very little change in color tone as a result of wear or fading. Perhaps slightly the darkest specimens in the entire series at hand are those taken at Helena, Trinity County, in February, and at a point 12 miles north-east of McCloud, Siskiyou County, in October. The full fresh condi-

tion of the pelage in these specimens may, in part, account for the maximum amount of dusky tipping to the hairs, which occurs particularly on the head, mid-dorsum and flanks.

With the large series of skins now available, much larger and representing many more localities than the series available to Miss Kellogg (1916, p. 366) when she named *Dipodomys californicus trinitatis*, I am unable to endorse her claims to the recognition of a separate race (type locality, Helena) under that name, upon the basis of color; and the cranial characters ascribed also fall, according to my present interpretation, into the category of minor variations not sufficient in importance to warrant subspecific separation.

The large suite of specimens now at hand from Sites, Colusa County, contains a few examples which upon direct comparison are seen to be slightly paler, more nearly cinnamon-buff, than any others of *californicus*. But, as already set forth by Miss Kellogg (1916, p. 367), there are no adequate grounds for recognizing any separate race from the vicinity of Sites (*pallidulus* of Bangs, 1899, p. 65). The great majority of the specimens from Sites are identical with the mean of a topotype series of *californicus* from Ukiah. Geographical variation in color within the range of this subspecies is at best exceedingly slight.

Juveniles of *californicus* are strikingly different from those of *agilis* only in the matter of the abrupt white tipping of the tail. This feature is conspicuous in youngsters even down to one-fourth grown. The tone of dorsal color in juvenile *californicus* is rather darker than in *agilis*, due to the more pronounced dusky over-wash; the nose and whisker patches (usually coalescing) are bolder, too, and the tail stripes are blacker, particularly where they meet subterminally in an almost pure black zone, which latter thus sets off the white tip to good advantage. Specimens in juvenile pelage vary in date from May 3 to November 2.

There is at hand one abnormal specimen, a juvenile from Sites (no. 167270, Biol. Surv. coll.), in which the prevailing tone of color is mouse gray. It looks as though the cinnamon-buff pigment had been left out of the pelage altogether, leaving chiefly or only the black in varying dilution.

*Variation in size.*—The largest examples of *californicus* occur in the northern part of its range. Using skulls as criteria, the very largest among the specimens examined come from Tule Lake, Modoc County (greatest length, 41.2 mm.), and Cassel, Shasta County (greatest length, 41.1). On the other hand, the smallest come from Marin County. Some of these latter are quite as small as the average of *eximius*, but the tone of color of the skins is distinctly of the *californicus* type, if anything more ruddy (that is, cinnamon) in tone of buff. This north-to-south gradient in general size does not, in the writer's opinion, involve such diverse extremes as to warrant division under separate names, especially in the absence of any other characters. If separation ever does seem desirable, it would be the animals of the Marin subfaunal area which should be named, for topotypes of *californicus* (from Ukiah, Mendocino County) stand nearest the larger extreme. The animals from Sites, Colusa County, seem to be of practically the same size as the Ukiah ones.

*Variation in skull.*—Aside from the variation already noted in general size of the skull, there are rather notable variations in proportions of certain parts. These peculiarities do not, however, seem to bear any relation to geography, and are probably in major part matters of individual variation.

One distinguishing character of the skull of *californicus*, as compared with the skulls of most other Californian species of *Dipodomys*, is the ordinarily great relative width of the supra-occipital and interparietal. In many specimens the latter is distinctly scutiform, with length to breadth about 3.5 to 3.0 millimeters. This condition might be interpreted as closely dependent upon the size of the mastoid bullae, which are, indeed, rather smaller in *californicus* in proportion to the whole skull than in most other species of the genus. As elsewhere suggested, this correlation may really obtain in some degree; but nevertheless we find in *californicus* occasional individuals in which the space between the two mastoid bullae is narrow, in other words, with the supra-occipital and interparietal transversely constricted; and in such specimens the bullae are not notably larger than normal. An example in point is no. 12859, adult male, from Helena, Trinity County, in which the interparietal is only 1.6 millimeters wide, about as in average *goldmani*. Various stages exist in the series at hand down to this degree of narrowness.

Another point of variation lies in the postero-external angulation of the maxillary arch on each side. Although the skulls of *californicus* are of the broad-faced type and characteristically have the angle just specified prominent, often produced into a sharp point, an opposite trend of variation brings a rounded angle, in extreme degree no better defined than in average *agilis* or *elephantinus*. No. 49059, Biol. Surv. coll., a large adult male from Cassel, Shasta County, and no. 75057, Biol. Surv. coll., a small female from Nicasio, Marin County, are examples of this condition.

Mastoid and auditory inflation also shows variation in degree. On one side of the mean is the diminutive extreme, exemplified in no. 13675, an adult male from Scott River, Siskiyou County. In this specimen the breadth of skull across bullae is but 23.5 millimeters, although the total length of the same skull is 40.7. The opposite extreme is illustrated in an adult male from Sites, Colusa County, no. 12966, in which the breadth of skull across bullae is 24.6, with the total length of the skull 39.7 millimeters. Except for the decidedly greater width (double at least) of the supra-occipital and interparietal, the latter skull is in all respects wonderfully like selected examples of *goldmani*.

*Toes.*—*Californicus*, as a characteristic condition, lacks altogether the first claw and digit on the hind foot. But occasional individuals occur which retain rudiments of these, and hence indicate an uncompleted process of loss. No. 13672, adult ♀, taken June 10, 1911, by Annie M. Alexander, near the Scott River, six miles northwest of Callahan, Siskiyou County, has clearly defined the claw of the first digit on each of the hind feet (see fig. M). The animal, both as regards external features and cranium, is otherwise normal for *californicus*. No. 12960, adult ♀, taken April 27, 1911, at Sites, Colusa County, shows a palpable swelling on the inside of each hind foot

marking the rudiment of a first digit, but there is no claw. No. 18391, half-grown ♀, taken June 28, 1912, at Rumsey, Yolo County, shows a rudimentary first claw on the left hind foot only.

*Measurements.*—Ten selected adult and subadult specimens, 5 males and 5 females, from Ukiah, Mendocino County, show average and extreme measurements, in millimeters, as follows: total length,

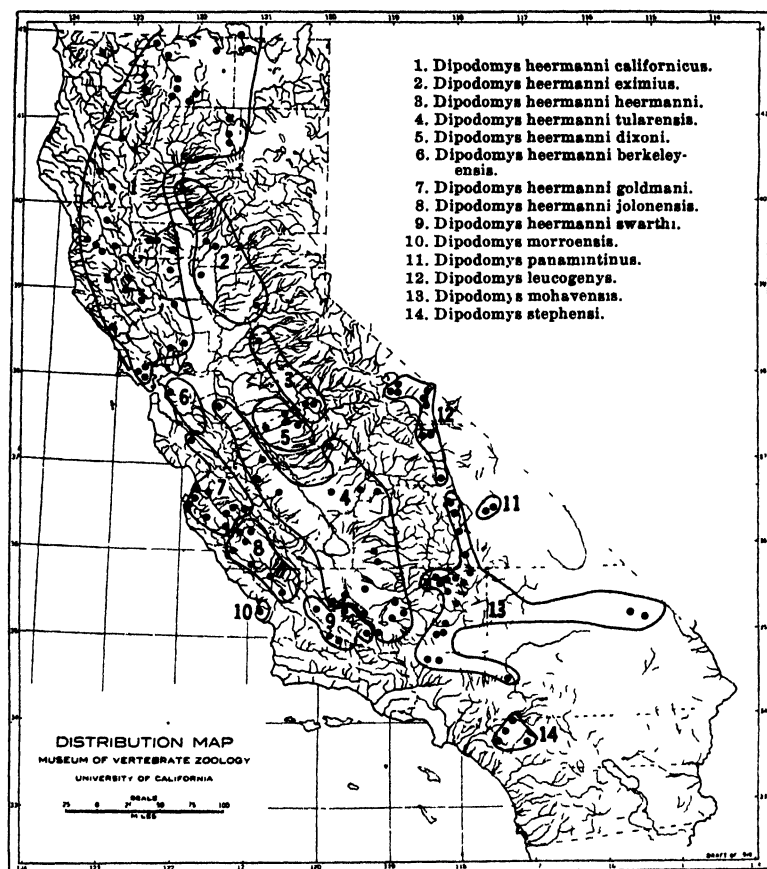


Fig. T. Map showing stations of occurrence in California of kangaroo rats of the *heermanni* group (except *ingens*), as established by specimens examined by the author. Assumed general range of each form within the state outlined.

312 (295–340); tail vertebrae, 195 (182–217); hind foot, 44.8 (43–47); ear from crown [as estimated from the dry skins], 14.7 (14–15.5); greatest length of skull, 39.2 (38.0–40.8); breadth of skull across bullae, 23.8 (23.1–24.7); spread of maxillary arches, 22.3 (21.2–23.4); greatest length of nasals, 14.6 (14.3–15.4); greatest width of rostrum near end, 3.8 (3.5–4.1); width of maxillary arch at middle, 5.3 (5.0–5.6).

Weights are not available for this species; but an estimate based on body length shows a probable average weight of 75 grams.

*Type locality*.—Ukiah, Mendocino County, California (Merriam, 1890b, p. 49). Type collected by Dr. T. S. Palmer, May 4, 1889, now no. 16618 23544, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 56).

*Distribution area*.—Northern California, chiefly east of the humid coast belt and west of the Sacramento and Pit rivers, north from San Francisco Bay and the Strait of Carquinez to (and beyond) the Oregon line. Altitudinal range, 200 to 4500 feet. Life-zone, Upper Sonoran and, locally, Transition. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Modoc County: east side Tule Lake, 4 (Biol. Surv. coll.). Siskiyou County: Hornbrook, 3 (Biol. Surv. coll.); two miles southeast Beswick, 1 (Biol. Surv. coll.); Brownell, 1 (Biol. Surv. coll.); Ager, 2 (Biol. Surv. coll.); six miles east Edgewood, 11 (Biol. Surv. coll.); Mayten, 1 (Biol. Surv. coll.); Sisson, 8 (3 in Biol. Surv. coll., 5 in coll. A. B. Howell); forest nursery, eighteen miles north McCloud, 1 (Biol. Surv. coll.); Pilgrim Creek, twelve miles northeast McCloud, 2 (Biol. Surv. coll.); Scott Valley, four miles south Fort Jones, 2 (Biol. Surv. coll.); Scott River, six miles northwest Callahan, 31. Shasta County: Fort Crook, 2 (Biol. Surv. coll.); Cassel, 15 (Biol. Surv. coll.); Hat Creek, fifteen miles south Cassel, 2 (Biol. Surv. coll.). Trinity County: Helena, 14; fifteen miles northwest Ruth, 1; Mad River, 3 (Biol. Surv. coll.). Mendocino County: three miles south Covelo, 5; six miles southwest Laytonville, 1; Sherwood, 2; near Willets, 1 (Biol. Surv. coll.); three miles west Mt. Sanhedrin, 10; Ukiah, 25 (15 in Biol. Surv. coll.). Glenn County: Winslow, 11; Alder Spring, 4200 feet, 1 (Biol. Surv. coll.); Willows, 1 (Biol. Surv. coll.). Colusa County: Sites, 48 (37 in Biol. Surv. coll., 2 in coll. Stanford Univ.). Lake County: Upper Lake, 1 (Biol. Surv. coll.); Lakeport, 1 (coll. Stanford Univ.); six miles west Lower Lake, 2 (Biol. Surv. coll.). Yolo County: Rumsey, 23. Solano County: Vacaville, 1. Napa County: Mt. George, 1 (Biol. Surv. coll.). Sonoma County: seven miles west of Cazadero, 1. Marin County: Novato, 1 (Biol. Surv. coll.); Lagunitas, 5 (Biol. Surv. coll.); Nicasio, 13 (11 in Biol. Surv. coll., 1 in coll. Stanford Univ.). Total number of specimens examined from California, 258.

### **Dipodomys heermanni eximius Grinnell**

#### **Lesser California Kangaroo Rat**

(Pl. 3, fig. 12; text-figs. 8, T)

*Dipodomys californicus*, Grinnell (1913, p. 342), part.

*Dipodomys californicus eximius* Grinnell (1919b, p. 205) [orig. descr.].

*Diagnosis*.—Similar to *D. californicus californicus*; essential characters the same. Differs in decidedly smaller size, the discrepancy being especially manifest in lesser dimensions of ear and of skull across bullae. Coloration slightly less deeply or brightly cinnamon-buff, tending towards pinkish buff extensively obscured with dusky.



*Comparisons and variations.*—*Eximius* is very closely related to *californicus*. It has the same type of skull in all major respects; in proportions the skull averages slightly shorter and squarer. The mastoid bullae are no larger in relative size, so that in actual size (by reason of the much smaller general size of the animal) they are very small indeed, in fact smaller than in any other member of the *heermanni* group, and even as small as in *exilis* of the *merriami* group, which latter is the smallest in general dimensions of all our kangaroo rats. All the specimens of *eximius* studied have the tail abruptly white-tipped and all are four-toed, that is, there is no trace of a claw to indicate the presence of a first toe on the hind foot. Small size, about 18 per cent less than in *californicus* on basis of bulk, is the subspecific character of *eximius*. The paleness in general coloration is slight and only average.

Specimens from Red Bluff are larger than *eximius*, and so are intermediate toward *californicus*; complete intergradation doubtless takes place from one form to the other through the foothill country in the head of the Sacramento Valley. The specimens from the southeasternmost locality for *eximius*, Limekiln, Eldorado County, well up in the western foothills of the Sierra Nevada, are quite as small as the type series from the Marysville Buttes, but are darker colored, practically as in *heermanni* and *californicus*.

*Measurements.*—Ten selected adult and subadult specimens, 5 males and 5 females, from Marysville Buttes, Sutter County, show average and extreme measurements, in millimeters, as follows: total length, 287 (269–303); tail vertebrae, 175 (165–182); hind foot, 41.6 (39.5–43); ear from crown, 12.5 (12–13); greatest length of skull, 36.6 (35.0–38.3); breadth of skull across bullae, 22.6 (21.9–23.0); spread of maxillary arches, 21.6 (21.1–22.0); greatest length of nasals, 13.7 (13.2–14.2); greatest width of rostrum near end, 3.9 (3.7–4.3); width of maxillary arch at middle, 4.9 (4.5–5.3).

Only two adult examples of this race have been weighed, both from Limekiln, Eldorado County: male, August 6, 62 grams; female, August 5, 59 grams. Average of the two, 60.5 grams.

*Type locality.*—Marysville Buttes at 300 feet altitude, 3 miles northwest of Sutter, Sutter County, California (Grinnell, 1919b, p. 205). Type collected by F. H. Holden, April 5, 1912; now no. 18347, Mus. Vert. Zool.

*Distribution area.*—The eastern side of the lower Sacramento Valley, including the Marysville Buttes, from the vicinity of Red Bluff, Tehama County, southeast to Limekiln, Eldorado County. Altitudinal range, 200 to 1200 feet. Life zone, Upper and Lower Sonoran. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Tehama County: Red Bluff [two and one-half miles northwest of], 3 (coll. D. R. Dickey); somewhere near Tehama [east of?], 4 (Biol. Surv. coll.). Butte County: Butte Creek, four miles southeast Chico, 4; eight miles east Nelson, 4 (Biol. Surv. coll.). Sutter County: Marysville Buttes, 20 (3 in Biol. Surv. coll.). Eldorado County: Limekiln, 3. Total number of specimens examined, 38.

**Dipodomys heermanni heermanni** LeConte**Heermann Kangaroo Rat**

(Pl. 3, fig. 13; text-figs. I, L, R, S, T)

*D[ipodomys]*. *Heermanni* LeConte (1853, p. 224) [orig. descr.].*Perodipus streatori* Merriam (1894, pp. 113-114) [orig. descr.]; and of many subsequent authors.*Crucetodipus Striatori*, Trouessart (1897, p. 581).*Perodipus streatori streatori*, Grinnell (1913, p. 337).

**Diagnosis.**—Externally identical in appearance with *D. heermanni californicus*, except that there is always present (in the specimens examined) the first (rudimentary) toe and claw on hind foot, and also that most individuals (over three-fourths of those examined) lack the clear white tipping to the tail, the tip of the tail then being colored nearly or quite as in *agilis*. Cranially close to *californicus*, save as showing more inflated bullae on an average and thus tending strongly towards *tularensis*. Width of supra-occipital and interparietal averaging less than in *tularensis*, about intermediate between the condition in that form and *tularensis*.

**Comparisons and variations.**—*Heermanni* presents a curiously unstable combination of the characters of *californicus* and *tularensis*, and might be interpreted as consisting of a series of specimens variously intermediate between the two. In respect to tone of coloration and pattern of markings, however, save for the items of smaller ear and white tail tip, *heermanni* is uniformly identical with *californicus*, and every specimen is unequivocally separable from typical *tularensis*. As to tail tip, 13 out of the 60 specimens at hand have this part abruptly pure white, exactly as in *californicus*; 32 have the tail dusky hued at end, as in *tularensis* and most other races; and 15 have an increase of whitish terminally in more or less intermediate degree short of the full white tip. This feature, then, of white tip or otherwise, varies within *heermanni* from the condition as it is in *californicus* to that in *tularensis*.

As regards the rudimentary (first) claw on the hind foot, all the specimens of *heermanni* possess this, as in *tularensis*, while normally in *californicus* it is absent. As already stated, however, some examples of *californicus* from far within the range of that form have the claw present. Thus the example of *californicus* from Scott River, Siskiyou County (no. 13672), which has this claw in evidence on both hind feet, is not distinguishable in external appearance from the type of *streatori* (= *heermanni*), except for markedly greater size of ear, somewhat larger general size, and blacker dorsal and ventral tail stripes.

Cranially, *heermanni* on an average is just about between the average of *californicus* and that of *tularensis*. The bullar inflations are greater, as a rule, than in *californicus*, with supra-occipital and interparietal narrower, and the rostrum narrower. In these respects the approach is directly towards the conditions in *tularensis*. In fact, due to the remarkable range of the individual variation in *heermanni*,

skulls from one locality, Carbondale, can readily be picked out which seem identical with skulls of *californicus*, and others can be found which appear identical with skulls of *tularensis*.

As will be seen upon examination of the table of measurements, *heermanni* averages not quite so large as *californicus*; yet, curiously, it is larger than *eximius*, the range of which race lies between that of *heermanni* and that of *californicus*. However, complete intergradation with *eximius* at the north is strongly indicated by the unstable behavior of the white tail tipping (as well as of the cranial characters) of the Amador County specimens of *heermanni*. Significantly, not one of the 14 specimens of *heermanni* from Mariposa County, at the south, shows white tail tipping; and this striking color feature is unknown in any other race of the *heermanni* group, to the southward. In other words, it is developed rather abruptly, but seemingly on a geographic basis, in a stretch of west-Sierran country between Mariposa County and Eldorado County. A good series of specimens from a number of localities on a north-and-south line through this country would warrant careful study, as to behavior both of white tail tipping and toe reduction.

*The applicability of the name heermanni.*—The original description of *Dipodomys heermanni* is included as part of a brief synopsis of the genus *Dipodomys* by Dr. John L. LeConte (1853, p. 224). It is as follows:

B. Tail as long as the head and body; hair at the tip scarcely longer; antitragus very short, indistinct.

3. D. Heermanni. Tail brown, becoming black towards the extremity, with a broad white vitta each side; tip pure black. Sierra Nevada; Dr. Heermann. (Specimen not quite adult.)

The above name and characterization have been considered by Allen (1891, p. 275) and other authors as "indeterminable." And furthermore the type has not been supposed to be still extant. But the contrary in both respects is the case, as will now be shown.

The type is number 229 in the mammal collection of the Academy of Natural Sciences, Philadelphia. It is an old mounted specimen, taken down, but still with the wires in it. The two tags now attached to the skin are new, the data having been copied by Dr. Witmer Stone from the bottom of the original stand when he came to the Academy and demounted various important specimens on exhibition there. The original stand is preserved. With the permission of Dr. Stone, now Executive Curator of the Academy, the present writer has examined this type and has had the skull removed from the skin, without, however, disturbing the original make-up of the skin in any conspicuous degree.

The animal is obviously not only "not quite adult," as remarked by LeConte, but is not more than half-grown. Fully two-thirds of the tail is now missing. The phrases "hair at tip [of tail] scarcely longer [than elsewhere on tail]" and "[tail] becoming black towards extremity, . . . tip pure black" apply precisely to the juvenile condition as exhibited, for example, by no. 30020 Mus. Vert. Zool., from Coulterville, Mariposa County. "Tail as long as the head and body" instead of "much longer than the head and body" (group "A" of

LeConte's synopsis), is, of course, also a character accompanying immaturity. As to "antitragus" there is nothing diagnostic one way or another.

The skin is discolored, the white areas to dirty yellowish, the black or dusky areas to brown. It is likely that the specimen was mounted from an alcoholic, especially inasmuch as the skin had never been separated from the anterior part of the skull. The dark tail stripes are broad and sharply outlined. The sole stripe is heavy. The hind foot measures 37.5 mm., practically the same as the young Coulterville example above referred to. The first claw is present on each hind foot. The ear is small, measuring only about 10 mm. from inner base, in this respect agreeing with the size of ear in other juvenals of the race to which the present writer applies the name *heermanni*. The ear is decidedly smaller than in *agilis* of similar age.

LeConte's description is based solely on external features. The skull, now available, is of so young an animal that the best diagnostic features are difficult to find. Also the whole basal part of the skull was destroyed, evidently in removing the brains when the specimen was mounted. But the mastoid bullae, the interparietal, and the roof of the cranium, together with the rostral parts and lower jaw are nearly or quite intact. Features of importance in identifying this skull are: size of mastoid bullae, breadth and shape of interparietal, width of rostrum, length of nasals, size of orbit, relative size and curvature of incisors, and size of cheek-teeth and length of molariform series. As far as can be seen this skull is identical with the skull of no. 30020, from Coulterville.

The gist of the matter is that, from skin or from skull, upon one character or another, it is possible to eliminate every other kangaroo rat in California except *berkeleyensis* and *goldmani*, and geographical considerations throw out these, leaving only the race for which the name *heermanni* is now resuscitated.

As regards type locality, the present label gives only "California." But LeConte gave "Sierra Nevada" which information he may have obtained directly from Heermann, the collector. It was thought possible once (Grinnell, 1913, p. 335) that the type of *Dipodomys heermanni* came from Fort Tejon, in Kern County, California. But Heermann did not visit Fort Tejon, so far as known, until 1853. His return from his first residence "of nearly three years" in California was announced at the Philadelphia Academy meeting of September 7, 1852 (see "Proceedings," p. 147). He "brought home the most extensive and valuable collection of birds ever made in that country, with many other interesting objects." It is of especial note here that Le Conte's paper containing the characterization of *D. heermanni* was read at the meeting of January 11, 1853.

Heermann, himself, wrote a report upon the land birds obtained on this first trip when, it is believed, he obtained also a number of mammals, including the type of *Dipodomys heermanni*. He states (1853, p. 259) that the birds upon which he reports were collected by him "in various parts of California, but principally in the vicinity of Sacramento city, from which, as a central point, I [he] made excursions to the gold mines on the American river, to the sources of the Cottonwood creek, which takes its rise in the coast range of

mountains, in the northern part of California, to the southern mines, on the Calaveras and Consummes rivers, and to the city of San Diego and its immediate neighborhood, on the shores of the Pacific Ocean."

In his notes on birds Heermann states distinctly that specimens of several species, which we now know to be of common occurrence in the Upper Sonoran life-zone were "procured" by him on the "Calaveras" and "Consummes" rivers. Also "mountains" surrounding the mines are frequently mentioned, and these are, of course, the western spurs of the central Sierra Nevada. The placer gold belt lies chiefly within the Upper Sonoran life-zone. In one place (p. 265) he implies that he spent the "summer of 1851" on the "Consummes river." In another place (p. 266) he implies that he spent "the spring of 1852" on the "Calaveras river" [= the type locality of the rufous-crowned sparrow, *Ammodromus ruficeps* Cassin].

Since the type of *Dipodomys heermanni* is a half-grown animal, and since the juvenile examples at hand of about the same age are of dates March 31, April 2, May 12, and June 2, we may consider the probabilities to be that the type was taken in "spring" and hence on the Calaveras River. The term "Sierra Nevada" would put the type locality well up into the foothills. The birds specifically reported by Heermann from the "Calaveras river" are chiefly Upper Sonoran species. And he brought home specimens of them from that very locality.

No kangaroo rats are available from Calaveras County; but Amador County, from which a large series is at hand, is next on the north, and Mariposa County, whence also a series is at hand, is once removed to the south. The Consummes River borders Amador County on the north, so that if, by any chance, the type had been obtained there, the same race of *Dipodomys* would undoubtedly have been represented.

It seems clear that Heermann during this first period of residence in California got representatives of two kinds of *Dipodomys*. In addition to the type of *D. heermanni* he got a species from the "Sacramento Valley" with the tip of the tail "pure white." This LeConte also includes in his synopsis, under the name "*D. Phillipii* Gray." It is interesting that LeConte should have (correctly) distinguished these two forms, now well known, respectively, as from the foothill belt of the central Sierra Nevada, and from the Sacramento Valley. It is likely that the "Sacramento Valley" animal represented the race now called *californicus* (or else, possibly, *eximius*). Gray's name *phillipii*, or *phillipsii*, as it is now restricted applies to a Mexican species not closely related to any kangaroo rat of California.

To review the case: The type of *Dipodomys heermanni* LeConte, like many old types, is an imperfect specimen; also it is a young animal. But it had, according to the describer, a black-tipped tail; it has a first claw on each hind foot; its ear is too small for *agilis* or any related race of same body size, so that San Diego is ruled out as a locality of possible capture; all features of skin and skull compare closest with a specimen of similar age from Mariposa County; the describer states that it came from the "Sierra Nevada"; its collector, Heermann, was on the Calaveras River in "the spring of 1852" and is known to have collected natural history specimens at that place and time, that is, within the known breeding territory and breeding season

of the form long afterwards called *streatori*. Hence it seems proved beyond doubt that the name *heermanni* should be employed for the race in question, the name *streatori* to be synonymized accordingly.

In this connection the writer has critically examined the type of *Perodipus streatori* Merriam (1894, p. 113). This specimen was collected at Carbondale, Amador (not "Mariposa") County, by Clark P. Streator, April 3, 1894, and is now no. 64310 Biol. Surv. coll., U. S. National Museum. While the tip of the tail of this specimen is abruptly pure white, as in *californicus*, this feature is, as already stated, exceptional. In other respects this type specimen is fairly representative of the average of *heermanni*.

*Measurements.*—Ten adult specimens, 5 males and 5 females, all from Carbondale, Amador County, show average and extreme measurements, in millimeters, as follows: total length, 293 (265–310); tail vertebrae, 180 (160–189); hind foot, 43 (41–46); ear from crown, 13.0 (estimated only, on basis of comparison of dried specimens with similar material of other species of known fresh dimension); greatest length of skull, 39.9 (38.0–41.5); breadth of skull across bullae, 24.7 (23.5–26.0); spread of maxillary arches, 22.6 (21.8–23.8); greatest length of nasals, 14.5 (13.5–15.3); greatest width of rostrum near end, 4.0 (3.8–4.1); width of maxillary arch at middle, 5.1 (4.8–5.4).

Weights, in grams, of four adults from six miles east of Coulterville, Mariposa County, taken July 21 to August 5, are as follows: males, 68.6 and 72.8; females, 69.5 and 70.0; average of all, 70.2.

*Type locality.*—Sierra Nevada, California (LeConte, 1853, p. 224); probably in Upper Sonoran Zone on Calaveras River, Calaveras County. Type collected by A. L. Heermann, probably in the spring of 1852; now no. 229, mammal coll. Academy of Natural Sciences, Philadelphia.

*Distribution area.*—West base of central Sierra Nevada, at least from Carbondale, Amador County, south to Coulterville, Mariposa County. Altitudinal range, 500 to 3200 feet. Life-zone, Upper Sonoran (lower edge of Transition locally). (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Amador County: vicinity of Carbondale, 46 (39 of these in Biol. Surv. coll.). Mariposa County: vicinity of Coulterville (one mile west to six miles east), 14. Also the type, as above. Total number of specimens examined, 61.

### **Dipodomys heermanni tularensis (Merriam)**

#### **Tulare Kangaroo Rat**

(Pl. 2, fig. 7; pl. 3, fig. 16; pl. 7, figs. 51, 52; text figs. S, T)

*Dipodomys phillipsi*, Baird (1857, p. 412), part.

*Dipodomys agilis*, True (1886, p. 412), part.

*Perodipus agilis tularensis* Merriam (1904, p. 143) [orig. descr.]; and, at least in part, of subsequent authors.

*Perodipus agilis streatori*, Elliot (1904, p. 305), part.

*Dipodomys tularensis*, Grinnell (1919b, p. 204).

*Diagnosis.*—Externally similar to *heermanni*, but coloration decidedly paler; tone of dorsal color near warm buff; white markings extended, dark markings reduced (for instance white lateral tail stripes halfway toward end, each about equal in width to dark ventral stripe); tail light grayish toward end but never abruptly tipped with white; claw of first digit on hind foot always present (in the material examined). Skull of broad-faced type like *californicus* and *heermanni*; bullae larger than in latter, even, interparietal and supra-occipital narrower, rostrum decidedly slenderer; incisors and molars not so heavy.

*Descriptive and comparative notes.*—*Tularensis* is just about a "medium" kangaroo rat in practically every respect. In pattern of coloration it does not differ markedly from *agilis*; in general tone it is paler than *agilis* and most other Pacific slope forms, and yet is darker than most desert species. The arietiform facial marking is distinct though very narrow between whisker patches and nose; the cheeks are grayish white, with fine black hair lines; the ear, which is decidedly smaller than in *agilis*, is weakly dusky save for white at lower base, and for distal two-fifths of upper fold-over which is silvery gray; the sides are clear warm buff with extensive white at bases of hairs; the dorsum is less obscured by dusky than in *heermanni*, and the dorsal and ventral tail stripes are not so black (in fact, nearer drab in tone); the white side-stripes of the tail run out farther towards the tip, grading into a dull whitish core in the otherwise dusky terminal tuft.

As to skull, *tularensis* shows itself to be no near relative of *agilis*; instead of narrow-faced as in the *agilis* group, it is very broad-faced, practically identical with *californicus* and *heermanni* in wide spread, great width, and prominent angulation of maxillary arches. The decidedly narrow rostrum and larger and closer approximation, in dorsal view, of the mastoid bullae are usually good features of difference from the two last named forms.

*Variations.*—The series of specimens from the southeastern end (head) of the San Joaquin Valley affords the basis of the concept of the race *tularensis* as here set forth. Departures in greater or less degree are shown in outlying parts of the general range of the form as here plotted. The specimens from the west side of the San Joaquin at the north (San Joaquin County) are slightly darker in tone of color, with dark markings a little more emphasized—seemingly a tendency towards *berkeleyensis*. Skulls from the west side of the floor of the San Joaquin Valley (western Fresno County, for instance) frequently show appreciably greater bullar inflation than in typical *tularensis*. This is, of course, to be interpreted as a geographic trend towards the extreme of inflation as found in *jolonensis* and *swarthi*, to the westward.

Specimens from the western foothill region of the Sierras (Raymond, Madera County, and Dunlap, Fresno County) are darker colored than valley specimens, with especially darker ears and blacker striped tails. These features, as also those of the skulls, indicate a close approach to *heermanni*. Two localities so close together as Dunlap and Minkler, both in Fresno County (18 miles apart), the former at 2000 feet altitude, the latter on the floor of the San Joaquin Valley,

produce specimens which differ appreciably in skull characters. The Minkler animals are nearly typical of *tularensis*, while the Dunlap ones depart towards *heermanni*. There is a possibility that another, Upper Sonoran, race ought to be recognized. Material is badly needed from many localities on the western flank of the Sierras all the way south to Kern County; as yet it is scanty, as will be seen from the enumeration of specimens examined.

*Measurements.*—Ten selected adult specimens, 5 males and 5 females, from Earlimart, Tulare County, and Caliente Creek wash, Kern County, give average and extreme measurements, in millimeters, as follows: total length, 294 (280–305); tail vertebrae, 175 (162–189); hind foot, 41.5 (40–42); ear from crown, 12.6 (12–14); greatest length of skull, 39.8 (38.9–41.2); breadth of skull across bullae, 25.1 (24.6–25.7); spread of maxillary arches, 22.4 (21.6–23.3); greatest length of nasals, 14.5 (13.9–15.2); greatest width of rostrum near end, 3.9 (3.5–4.2); width of maxillary arch at middle, 5.0 (4.5–5.4).

Weight, in grams, of the same ten specimens, three of which were taken May 18 to 21, and the rest all on March 25: 73.4 (60.0–83.4).

*Type locality.*—Alila [=present town of Earlimart], Tulare County, California (Merriam, 1904, p. 143). Type collected by Luther J. Goldman, June 23, 1903; now no. 127158, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 62).

*Distribution area.*—In major part, the floor of the San Joaquin Valley. Extends to the northward not farther on the eastern side than the vicinity of Raymond, Madera County, but on the western side to near Tracy; southeastward to vicinity of Bakersfield and Buena Vista Lake. Altitudinal range, 120 to 3000 feet. Life-zone mostly Lower Sonoran, but reaching into Upper Sonoran along the Temblor Mountains, west of McKittrick, and on the lower western slopes of the Sierra Nevada. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. San Joaquin County: Corral Hollow, eight miles southwest of Tracy, 13. Merced County: Los Baños, 6; Sweeney's Ranch, twenty-two miles south of Los Baños, 12. Madera County: Raymond, 2. Fresno County: Panoche Creek at 503 feet altitude, 14; eight miles southwest of Fresno, 1; Dunlap, 3; Minkler, 6. Tulare County: Tipton, 8; Earlimart, 5. Kern County: Wasco, 1 (in coll. Calif. Acad. Sci.); eight miles northeast of Bakersfield, 22; fifteen miles south of Bakersfield, 2 (in coll. A. B. Howell); wash of Caliente Creek, 600 to 800 feet altitude, 48; lower San Emigdio Creek wash, at 450 feet, 4; three miles north of Buena Vista Lake, 1 (in coll. D. R. Dickey); Buttonwillow, 16 (in coll. Calif. Acad. Sci.); divide at 3000 feet, twelve miles west of McKittrick, 5. Total number of specimens examined, 169.



**Dipodomys heermanni dixonii** (Grinnell)

## Merced Kangaroo Rat

(Pl. 3, fig. 15; pl. 7, fig. 50; text-figs. S, T)

*Perodipus dixonii* Grinnell (1919a, p. 45) [orig. descr.].

**Diagnosis.**—About intermediate in depth of coloration between *tularensis* and *heermanni*; general size decidedly less than in either. Skull comparatively small, with less inflated bullae, and with notably shorter nasals (averaging only 13.2 mm. long). Very close in size and external appearance to *eximius*, but end of tail dusky and first claw on hind foot always present (in specimens examined).

**Comparisons.**—*Dixonii* is remarkable in the *heermanni* group for its small size. Only *eximius*, in this group, also a valley race, is as small. *Dixonii* and *eximius* are wonderfully alike in external appearance; only the presence of the white tail tip and the absence of the first hind claw, in the latter, are absolutely diagnostic features. Skulls of these two races, however, while equally broad-faced and of about the same mass, show decided differences; in *dixonii* the mastoid bullae are somewhat more inflated, the supra-occipital and interparietal conspicuously narrower, the nasals shorter and much narrower posteriorly, and the incisors slenderer.

From *tularensis*, *dixonii* differs in somewhat darker tone of dorsal color, more towards clay color, with strong over-wash of dusky; the ears and tail stripes are blacker, and facial dark markings bolder. It is not so dark-colored, however, on an average, as *heermanni* and *goldmani*. The skull of *dixonii* differs from that of *tularensis* not only in general smaller size, but in relatively much less inflated bullae (both mastoid and auditory), and in decidedly shorter nasals which are also narrower posteriorly. As compared with *heermanni*, of the nearby Upper Sonoran basal slopes of the Sierras, *dixonii* has a skull of notably smaller size; the bullae are somewhat smaller and the nasals are much shorter and narrower posteriorly.

**Variations.**—While the dark markings in *dixonii*, notably the arietiform one on the face, are always bold, more so than in *tularensis*, the color of the dorsum varies considerably as to depth. In the type specimen and one topotype, for instance, the general tone is less heavily dusky, more clearly clay color, than in the specimens from the vicinity of Snelling. The type locality, Delhi, is farther out in the San Joaquin Valley from the foothills of the Sierras, so that the darkness of the Snelling examples may be interpreted as in the nature of a tendency towards *heermanni*. Their skulls, however, are all small.

One specimen of *dixonii*, an immature male (no. 21849) from near Snelling, has a small tuft of white hairs (about 11 mm. long) on the tip of the tail. This is interesting as an indication of a possible "strain" in *dixonii*, as is so much more manifest in *heermanni*, for white end of tail.

**Measurements.**—Ten adult and subadult specimens, 6 males and 4 females, from Delhi and Snelling, Merced County, and Lagrange,

Stanislaus County, give average and extreme measurements, in millimeters, as follows: total length, 283 (250–302); tail vertebrae, 170 (160–182); hind foot, 41.1 (38–43); ear from crown, 14.1 (13–15); greatest length of skull, 37.0 (36.2–37.8); breadth of skull across bullae, 23.2 (22.6–23.8); spread of maxillary arches, 21.0 (20.4–21.8); greatest length of nasals, 13.2 (12.7–14.3); greatest width of rostrum near end, 3.6 (3.3–4.0); width of maxillary arch at middle, 4.8 (4.4–5.4).

Weight, in grams, of eight out of the above ten specimens, two of which were taken March 23, one December 18, and five January 7 and 9: 61.4 (50.0–72.5).

*Type locality*.—Delhi, near Merced River, in Merced County, California (Grinnell, 1919a, p. 45). Type collected by Joseph Dixon, March 23, 1917; now no. 26805, Mus. Vert. Zool.

*Distribution area*.—Floor of lower (northern end) San Joaquin Valley, on the eastern side of the San Joaquin River, in Stanislaus and Merced counties. Altitudinal range, below 500 feet. Life-zone, Lower Sonoran. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Stanislaus County: three miles south of Lagrange, 3. Merced County: near Delhi, 2; five miles north of Snelling, 12; one and one-half miles south of Merced Falls, 1. Total number of specimens examined, 18.

### ***Dipodomys heermanni berkeleyensis* (Grinnell)**

#### **Berkeley Kangaroo Rat**

(Pl. 3, fig. 14; pl. 6, fig. 47; text-figs. S, T)

*Perodipus berkeleyensis* Grinnell (1919b, p. 204) [orig. descr.].

*Diagnosis*.—Similar to *tularensis* in main characters, but differs in darker scheme of coloration (dorsal tone near clay color, strongly over-washed with dusky, dark markings bold, dorsal and ventral dark tail stripes each at least twice width of lateral white stripes). Skull like that of *tularensis*, but rostrum wider, mastoid bullae much smaller, and interparietal and supra-occipital broader. Externally, practically identical with those specimens of *heermanni* which have dusky-ended tails; skull the same as in *heermanni* but bullae slightly less inflated and height of skull at bullae decidedly less.

*Status and comparisons*.—Of all the forms comprising the *heermanni* group, *berkeleyensis* has caused the writer the most trouble. There are plenty of good differences to separate it from *tularensis* and *dixonii* on the one hand and fairly good ones from *goldmani* on the other. But it is remarkably like *heermanni*, located on the lower west base of the Sierra Nevada clear across the San Joaquin Valley, with the ranges of *tularensis* and *dixonii* intervening. One difficulty lies in the fact that specimens of *berkeleyensis* at hand are so few, only four; a larger series might swing the "average" (which determines the concept of the race as here formulated) a little one way or the other.

*Berkeleyensis*, so far as specimens at hand go to show, is identical with *heermanni* in all features of coloration. As to dimensions, only the ear seems to differ materially, being slightly smaller. The skull shows slightly less bullar inflation, but not of sufficient amount alone to warrant separation. But one seemingly good character remains, a peculiar shallowness of the cranium posteriorly. When viewed from the side, the top of the skull is seen to slope off markedly down to the posteriormost protuberances of the mastoid bullae, which protuberances therefore appear sharper than in *heermanni*. In other words, the hinder end of the skull in profile is distinctly less truncate in *berkeleyensis* than in *heermanni*, and the depth of skull back of the parietals is less. For example: this measurement in the type of *berkeleyensis* is 12.6 mm.; in *heermanni* no. 18408 it is 13.3.

This same character, shallowness of the skull behind, sets off *berkeleyensis* from all other kangaroo rats of west-central California except *morroensis*, and, perhaps, *dixonii*. But *morroensis* is separable by absolutely diagnostic features of coloration; and *dixonii* is smaller, and has a weaker rostrum and dentition, and much shorter nasals.

Externally *berkeleyensis* closely resembles *californicus*, the nearest approach of whose range lies but a few miles to the north, just across San Pablo Bay. The presence of the first claw on the hind foot and the dusky ending of the tail, however, are diagnostic. The skulls of these two forms are remarkably alike as to relatively small bullae and heavy rostrum, but *berkeleyensis* shows narrower interparietal and supra-occipital, and, again, the shallowness of the skull behind is diagnostic, in comparison with the large majority, at least, of the skulls of *californicus*.

The similarities and differences obtaining between *berkeleyensis* and *goldmani* are discussed under the latter.

*Measurements.*—The two full-grown fresh specimens at hand, both from Berkeley, measure in millimeters, as follows, the measurements of the male (type no. 28729) being given first, then those of the female (no. 28770): total length, 301, 250 [defective]; tail vertebrae, 180, 125 [defective]; hind foot, 41, 41; ear from crown, 12, 12 [this second figure from dry specimen]; greatest length of skull, 39.5, 39.0; breadth of skull across bullae, 24.1, 23.7; spread of maxillary arches, 23.0, 22.1; greatest length of nasals, 14.5, 14.7; greatest width of rostrum near end, 4.5, 4.3; width of maxillary arch at middle, 5.0, 5.0.

Weights, in grams, of the same two specimens, the first (male) taken October 6, the second (female) November 30: 77.0, 65.2 (average, 71.1).

*Type locality.*—Top of Dwight Way Hill, 1100 feet altitude, Berkeley, Alameda County, California (Grinnell, 1919b, p. 204). Type collected by J. Grinnell and D. D. McLean, October 6, 1918; now no. 28729, Mus. Vert. Zool.

*Distribution area.*—Presumably the Mount Diablo range and adjacent hills to the east of San Francisco Bay. (See map, fig. T.) Life-zone, Upper Sonoran. Only the one locality, Berkeley, represented in the material actually handled. This material comprises but 4 specimens.

**Dipodomys heermanni goldmani** (Merriam)

## Salinas Kangaroo Rat

(Pl. 3, fig. 17; pl. 6, fig. 48; text-figs. E, S, T)

*Dipodomys phillipii*, Baird (1857, p. 412), part (?).*Dipodomys phillipsi*, Coues (1877, pp. 538, 540), part (?).*D[ipodomys]. agilis*, True (1886, p. 412), part (?).*Perodipus goldmani* Merriam (1904, p. 143) [orig. descr.]; and of subsequent authors.*Dipodomys goldmani*, Grinnell (1919b, p. 203).

**Diagnosis.**—Closely similar to *berkeleyensis*; practically the same in coloration, but ear slightly larger, tail less heavily crested and tufted, mastoid bullae slightly larger and especially higher, and rostrum of skull slightly longer and slenderer.

**Descriptive notes and comparisons.**—A marked feature of *goldmani*, shared with only one other kangaroo rat in California, *morroensis*, is the extremely scanty hairing of the tail. The longest hairs on a selected average specimen, measured from tip of tail proper, are only 16 millimeters long (as compared with 21 mm. in *californicus* and 31 in *tularensis*); the lengthened hairs running forward a ways along the top of the tail from the terminal tuft are commensurately short. Although identical in these respects with *morroensis*, the latter has another feature, the nearly or quite complete obliteration of the white flank stripe, which is diagnostic; *goldmani* has this white flank stripe invariably present and complete.

While *goldmani* is a dark-colored kangaroo rat, it is not so dark as *morroensis* or *venustus*. It is nearly indistinguishable in color from *berkeleyensis* and from those examples of *heermanni* which do not have the white tipping of the tail. The facial arietiform marking is bold and black; the ear is chiefly blackish brown, there being but a very small silvery patch at tip of upper fold-over; the dorsal and ventral tail stripes are each more than twice the width of either of the lateral white stripes; the tail tuft is peripherally blackish brown, with a small core of grayish white.

*Goldmani* differs externally from its near neighbors of the *agilis* group, *venustus*, *sanctiluciae*, and *elephantinus*, among other respects in its much smaller ear (usually 13.5 millimeters in height from crown or under, as compared with 15 or over in the races named), and in its far less heavily crested and tufted tail.

Cranially, *goldmani* shows the gross characters of the *heermanni* group, not at all those of the *agilis* group: the maxillary arches are relatively wide-spreading and sharply angled; indeed, the postero-external angle in some specimens is even recurved. While the bullae are less inflated than in *jolonensis*, *swarthi*, and even, on an average, *tularensis*, they are decidedly larger than in *morroensis* and slightly larger than in *berkeleyensis*.

**Variations.**—Skins from Bear Valley, San Benito County, tend toward *tularensis* in coloration, in that the dorsal tone is paler, more

ochraceous, than in typical *goldmani*, the facial marking is not so bold, the ears and the dark tail stripes are not so black, the white lateral tail stripes are not so narrow, and the tail is not so scantily haired at end. Intergradation thus probably takes place to the eastward, from valley to valley, between *goldmani* and *tularensis*.

Skulls from Soledad, up the Salinas Valley some thirty miles southeast of Salinas, show slightly more inflated bullae than the average of specimens from the mouth of Salinas Valley, evidently a tendency toward *jolonensis*.

The very darkest colored *goldmani* are from the immediate neighborhood of the seacoast north of Monterey, from near Seaside to near the mouth of the Salinas River.

*Measurements*.—Ten adult specimens, 5 males and 5 females, from vicinity of Seaside, Monterey County, show average and extreme measurements, in millimeters, as follows: total length, 291 (276–305); tail vertebrae, 178 (163–188); hind foot, 42.2 (40–44); ear from crown, 13.3 (12–14); greatest length of skull, 39.3 (38.0–41.4); breadth of skull across bullae, 24.1 (23.4–25.0); spread of maxillary arches, 22.3 (21.5–23.7); greatest length of nasals, 14.4 (13.6–15.5); greatest width of rostrum near end, 3.8 (3.6–4.2); width of maxillary arch at middle, 5.1 (4.8–5.7).

Weights, in grams, of the above ten specimens, which were taken from December 15 to January 31, were as follows: average, 68.1 (61.2–88.4).

*Type locality*.—Salinas, Monterey County, California (Merriam, 1904, p. 143). Type collected by Luther J. Goldman, September 4, 1902; now no. 118924, Biol. Surv. coll., U. S. National Museum. Type critically examined by present author, March 30, 1919.

*Distribution area*.—The lower (northern) end of the Salinas Valley and adjacent smaller valleys and bare hillsides, from the seacoast on Monterey Bay just south of the mouth of the Salinas River southeast to vicinity of Soledad; east to Bear Valley, in vicinity of Cook P.O., in San Benito County, and thence north to San José, in Santa Clara County. Altitudinal range, sea-level up to about 1300 feet. Life zone, Upper Sonoran. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Monterey County: sandhills, two miles south of mouth of Salinas River, 16; Seaside, 59 (45 in Biol. Surv. coll.); Del Monte, 2 (in Biol. Surv. coll.); Monterey, 2 (in coll. Stanford Univ.); Salinas, 39 (in Biol. Surv. Coll.); Soledad, 13 (1 in Biol. Surv. coll.); Arroyo Seco, south of Paraiso Springs, 13 (in Biol. Surv. coll.); Jamesburg, in valley of Carmel River, 3 (in Biol. Surv. coll.); Stonewall Creek at 1300 feet, six miles northeast of Soledad, 12. San Benito County: Cook P.O., 1300 feet, Bear Valley, 14 (11 in coll. Stanford Univ.). Santa Clara County: San José, 1 (in coll. Stanford Univ.). Total number of specimens examined, 174.

**Dipodomys heermanni jolonensis** Grinnell

## Jolon Kangaroo Rat

(Pl. 2, fig. 6; pl. 3, fig. 18; pl. 6, fig. 49; text-figs. E, Q, S, T)

*Dipodomys jolonensis* Grinnell (1919b, pp. 203-204) [orig. descr.].

**Diagnosis.**—Resembles *goldmani* in main features, but size somewhat greater, bullae decidedly more inflated, interparietal and supra-occipital narrower, tail more heavily crested and tufted, dorsal body-color paler, light markings on head whiter, white tail stripes broader, and dark tail stripes proportionately narrower and more or less grizzled instead of solidly blackish. Similar to *tularensis* in tone of body color, but facial arietiform marking much more conspicuous, mastoid bullae decidedly more swollen, rostrum heavier and teeth larger.

**Comparisons.**—Because of the relatively pale colors of *jolonensis* elsewhere about the head, the bold black facial double crescent shows forth with extreme conspicuousness. Unusual contrast is also shown by the markings of the ear, where the silvery white terminal portion of the upper fold-over is set off sharply against the blackish-haired remainder of the pinna. All such color features, as usual, are exhibited best in fresh-pelaged, unworn and unfaded, fall and winter skins; spring and summer specimens show more or less fading of the dark markings.

As regards color features, *jolonensis* might fairly be considered a "mosaic intermediate" between *goldmani* and *tularensis*. But when skulls are examined, differences from both of these races stand out plainly. The main feature is the greater size of the bullae in *jolonensis*. This difference is especially plain when skulls are viewed from behind; then the height of the skull is seen to be decidedly greater, and the outer declivity of the mastoid and auditory bullae together is seen to be steeper, more nearly vertical, in *jolonensis*. The skull in *tularensis* is much shallower and flatter topped, and there is not so much of an interparietal depression or sulcus between the dorsal portions of the mastoid bullae. The nasals in *jolonensis* are decidedly wider throughout their length than in *tularensis*.

**Variations.**—Three skulls out of the series from the vicinity of Jolon, all females (nos. 29089, 29091, 29093), are quite different from all others of *jolonensis* in that the bullae are decidedly smaller and the rostra slightly shorter. The mastoid bullae in one of these specimens are as small as in *berkeleyensis*, almost as small as in *morroensis*. But the skull as a whole is wider, the spread of maxillary arches notably greater, than in either of those forms. A tendency towards the neighboring *morroensis* might be inferred, only in coloration the specimens concerned are absolutely different, indeed quite typical of *jolonensis*.

**Measurements.**—Ten adult and subadult specimens, 5 males and 5 females, from San Lucas, upper Salinas Valley, Monterey County, give average and extreme measurements, in millimeters, as follows: total length, 304 (295-313); tail vertebrae, 188 (175-200); hind foot,

43.6 (42-45); ear from crown, 14.1 (14-15); greatest length of skull, 41.6 (40.2-42.9); breadth of skull across bullae, 25.5 (24.6-26.0); spread of maxillary arches, 22.9 (21.3-23.9); greatest length of nasals, 14.9 (14.1-15.5); greatest width of rostrum near end, 4.3 (3.9-4.9); width of maxillary arch at middle, 5.3 (5.0-6.0).

Weight, in grams, of ten specimens from the same locality, taken November 20 to 28: 87.7 (79.6-93.3).

*Type locality*.—Open valley floor one mile southwest of Jolon, Monterey County, California (Grinnell, 1919*b*, p. 203). Type collected by J. Dixon, October 18, 1918; now no. 29087, Mus. Vert. Zool.

*Distribution area*.—The upper (southern) end of the Salinas Valley and tributary valleys, from vicinity of King City and Peachtree, in Monterey County, south at least to Creston, in San Luis Obispo County; west to Jolon. Altitudinal range, 400 to 1500 feet. Life-zone, chiefly Lower Sonoran. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Monterey County: King City, 20 (in Biol. Surv. coll.); San Lucas, 32; Peachtree Valley, 1475 feet, 7; Jolon, 25 (14 in Biol. Surv. coll.); Pleyto, 2 (in Biol. Surv. coll.). San Luis Obispo County: 2 miles south of San Miguel, 6; Creston, 1 (in coll. Stanford Univ.). Total number of specimens examined, 93.

### ***Dipodomys heermanni swarthi* (Grinnell)**

Carrizo Plain Kangaroo Rat

(Pl. 3, fig. 19; text-figs. I, S, T)

*Perodipus agilis tularensis*, Grinnell (1913, p. 336), part.

*Perodipus swarthi* Grinnell (1919*a*, p. 44) [orig. descr.].

*Dipodomys swarthi*, Grinnell (1919*b*, p. 203).

*Diagnosis*.—Similar to *jolonensis* in general size and in characters of skull, but coloration much paler and dark markings reduced. Similar to *tularensis* but larger and coloration decidedly brighter, more clearly ochraceous-buff; skull larger, rostrum longer and heavier, and bullae more inflated.

*Comparisons and relationships*.—*Swarthi* is the palest in coloration, or perhaps better expressed, the least suffused with dusky, of all of the species of *Dipodomys* occurring in California west of the desert divides. When compared with, say, *californicus*, it is difficult to believe that *swarthi* is not a distinct species. But adequate series of specimens, from localities properly situated for the purpose, show practically complete intergradation along two routes: by the way of *tularensis* to *heermanni* and thence to *californicus*, and by the less direct way of *jolonensis* and *goldmani* to *tularensis* and thence through *heermanni* to *californicus*.

It will be seen from the lists of specimens examined that *swarthi* and *tularensis* are both recorded from the one locality, San Emigdio Creek wash. This would seem to argue for specific status for the two forms. This view of their relationship is further supported by the presence of good *tularensis* at the top of the divide almost directly

between McKittrick and Carrizo Plain, in each of which localities typical *swarthy* occurs. Yet, as stated in the preceding paragraph, material from other localities seems to demonstrate complete intergradation. It is quite possible that further specimens from the San Emigdio country would show that the mean of the animals there would fall into intermediate position, and that the specimens which the writer now identifies definitely with one or the other of the forms in question would prove to be merely extremes in one widely varying population. Obviously, only the acquisition of much more material representing the localities of critical position will settle this and similar points concerning the relationships of the forms.

In general tone of dorsal color, *swarthy* is about the same as *mohavensis*, of the Mohave Desert. It differs from that species externally only in greater size of ear, in slightly more extensively dusky facial markings, in somewhat narrower lateral white tail stripes, and in less grizzled dorsal and ventral dark tail stripes. Cranially, the vastly greater volume of the bullae in *swarthy* is, alone, diagnostic.

As regards bullar inflation *swarthy* shows the greatest development in the *heermanni* group (not counting the greatly larger *ingens*) except *jolonensis*, which race is about equal to it in this respect. It is at the opposite extreme from *morroensis* in both this respect and depth of color; yet *morroensis* is a very near neighbor, only some 40 miles away to the westward across two or three ranges of low coastal mountains.

*Measurements*.—Six adult specimens, 2 males and 4 females, from Carrizo Plain, show average and extreme measurements, in millimeters, as follows: total length, 297 (282–313); tail vertebrae, 175 (167–187); hind foot, 43.5 (42–45); ear from crown, 11 (10–12); greatest length of skull, 41.1 (39.9–41.8); breadth of skull across bullae, 25.8 (25.2–26.2); spread of maxillary arches, 23.0 (22.0–23.7); greatest length of nasals, 15.0 (14.3–15.5); greatest width of rostrum near end, 4.1 (3.6–4.3); width of maxillary arch at middle, 5.1 (4.0–5.6).

The only weights so far available are of two males taken April 30 and May 6 in or near the wash of San Emigdio Creek, and these average 87 grams (80.0–94.5).

*Type locality*.—Seven miles southeast of Simmler, Carrizo Plain, San Luis Obispo County, California (Grinnell, 1919a, p. 44). Type collected by H. S. Swarth and W. L. Chandler, May 26, 1911; now no. 14440, Mus. Vert. Zool.

*Distribution area*.—The extreme southwestern border of the San Joaquin Valley, in vicinity of McKittrick and San Emigdio, and also the Carrizo and Cuyama plains; the stations of occurrence lie in extreme southwestern Kern County, southeastern San Luis Obispo County, and northern Santa Barbara County. Altitudinal range, 300 to 2000 feet. Life-zone, Lower Sonoran. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Kern County: Lower San Emigdio Creek wash, 450 to 600 feet altitude, 3; McKittrick, 13. San Luis Obispo County: Carrizo Plain, 2000 feet, seven miles southeast of Simmler, 7; Cuyama Valley at 1900 feet, 1. Santa Barbara County: Cuyama Plain, 12 (in coll. Calif. Acad. Sci.). Total number of specimens examined, 36.



**Dipodomys morroensis** (Merriam)**Morro Bay Kangaroo Rat**

(Pl. 1, fig. 2; pl. 2, fig. 5; pl. 4, fig. 20; text-figs. E, I, S, T)

*Perodipus streator simulans*, Merriam (1904, p. 144), part.*Perodipus morroensis* Merriam (1907, p. 78) [orig. descr.]; and of authors.

**Diagnosis.**—The darkest colored of all known kangaroo rats. The only species in which there is not a sharp and continuous pure white band across outer side of flank to set off a "thigh patch" of dark color from rest of dorsal area; arietiform facial patch broad, continuous and jet black; white side-stripes of tail each less than one-half width of either dorsal or ventral black tail stripe; tail weakly crested and tufted. Skull showing main characters of *heermanni* as regards wide spread and sharp angulation of maxillary arches, but bullae small and skull posteriorly shallow, more nearly as in *berkeleyensis*.

**Descriptive notes.**—The dorsal color in *morroensis* is tawny-olive, clearest on sides and strongly overwashed with blackish on top and sides of head and down middle of back; the basal portion of the pelage is slate color on the mid-dorsum, paling down the sides to light gull gray next to the abrupt dorso-ventral line of color demarcation. In some specimens the white hip stripe, though not complete, is well indicated, there being only a wash of pale tawny-olive across the middle of it; in other specimens there is scarcely any trace of it; the remnant most likely to remain is the end toward the base of the tail. The ankles are black, and in most specimens this black is continuous over the outside of the joint with the sole stripe, which is extra broad and black. In many examples the ear is entirely black; in some there is a little gray at tip of upper fold-over; there is but a little grayish white at forward base of ear; the silvery white at hinder base is present, but less in amount than in *venustus* or *californicus* even; usually no trace of it shows forth, when ear is lying flat against hind neck. The cheeks are grayish white, much lined with dusky, and the spot above the eye is not only very small (less than 2 mm. in vertical diameter) but is not clear white, by reason of a buffy tinge which pervades it more or less deeply. The facial double crescent or arietiform marking is heavier and blacker than in any other kangaroo rat, not excepting the strongly marked *venustus*, *californicus*, and *goldmani*. The whole top of the nose is involved, for a length of 5 mm. at least, and the backward diverging bases of the "horns" are solidly and continuously black to their expanded and downward-directed ends at the bases of the longer vibrissae; the vibrissae themselves are more largely black or dusky than in most forms of *Dipodomys*.

The tail in *morroensis* is comparatively scant in its terminal hairing; only *goldmani* is so weakly crested and tufted. The longest hairs at tip, in different specimens, measure from 16 to 20 mm. long. The dorsal and ventral tail stripes are very broad and almost solidly black, only a faint trace of grizzling being discernible; the lateral white stripes are correspondingly narrow, at most only about one-third the

width of the dorsal black stripe; in some specimens they nearly or quite pinch out towards base of tail, so that the tail just posterior to the white basal collar is black all around; the white basal collar itself is much reduced. Toward the end of the tail, too, the white lateral stripes pinch out, so that the tuft is blackish with but indistinct grayish core.

The juvenile pelage is not one whit less extreme in darkness of general tone or in restriction of white markings than the adult pelage. Half-grown youngsters differ from adults chiefly in being of a leaden hue (near fuscous-black) due to far less of the tawny color in the pelage. *Morroensis* is thus notable for being the most heavily pigmented of all kangaroo rats. This condition is associated with a very restricted seaside habitat, within California's fog belt.

As to skull, *morroensis* shows the essential features of the *heermanni* group; the maxillary arches are wide-spreading and prominently angled. The bullar inflation is slight, nearest in degree to that in *berkeleyensis* and *dixonii*; the interparietal and supra-occipital are decidedly broader than in *jolonensis* and *tularensis*, more as in *goldmani*. As viewed laterally, the skull of *morroensis* slopes off more steeply back of the fronto-parietal sutures, than in all the other related races except *berkeleyensis*.

All the 61 specimens examined have the first claw on the hind foot present.

*Measurements*.—Ten selected adult specimens, 5 males and 5 females, all from the south side of Morro Bay, give average and extreme measurements, in millimeters, as follows: total length, 296 (275–308); tail vertebrae, 176 (164–185); hind foot, 42.6 (42–44); ear from crown, 13.5 (13–14); greatest length of skull, 38.9 (37.4–40.0); breadth of skull across bullae, 23.4 (22.5–24.3); spread of maxillary arches, 21.9 (21.1–23.2); greatest length of nasals, 14.4 (13.3–14.9); greatest width of rostrum near end, 4.0 (3.7–4.1); width of maxillary arch at middle, 5.1 (4.9–5.5).

Weight, in grams, of the same ten adults as measured above, taken September 25 to 27 and November 6: 68.0 (60.6–81.0).

*Type locality*.—Morro, San Luis Obispo County, California (Merriam, 1907, p. 78); more exactly, south side of Morro Bay, about four miles south of town of Morro (*vide* E. W. Nelson, in conversation).

Type collected by E. W. Nelson, November 11, 1891; now no.  $\frac{31626}{43499}$

Biol. Surv. coll., U. S. National Museum. Type critically examined by the present author, December 26, 1919.

*Distribution area*.—Sandy ground in the immediate vicinity of Morro Bay, San Luis Obispo County. Area of known habitat less than four miles square. Altitudinal range, sea level up to 250 feet. Life-zone, Upper Sonoran. (See map, fig. T.)

Specimens examined, 61, all from the type locality, as above; one of these was the type, skin and skull, loaned from the collection of the United States Biological Survey.

**Dipodomys mohavensis** (Grinnell)

## Mohave Kangaroo Rat

(Pl. 1, fig. 3; pl. 4, fig. 21; pl. 6, fig. 46; text-figs. E, I, S, T)

*Dipodomys phillipsi*, Stephens (1887, pp. 42-43, pl. 5). Recorded from Mohave River [near Hesperia, San Bernardino County].

*Perodipus agilis streatori*, Elliot (1904, p. 305), part.

*Perodipus panamintinus*, Stephens (1906, p. 154), part; and, in part at least, of some other authors.

*Perodipus streatori*, Elliot (1907, p. 329), part.

*Perodipus mohavensis* Grinnell (1918, p. 428) [orig. descr.].

**Diagnosis.**—A rather large sized, five-toed, pale-colored species. Dorsal color tone ochraceous-buff. Externally similar to *swarthi*, but ear smaller, dusky facial markings a little heavier, lateral white stripes on tail broader, and dark stripes more grizzled. Skull of broad-faced type essentially as in other members of the *heermanni* group; maxillary arches extreme in both spread and width, and postero-external angles very prominent. Bullae relatively small, about as in *berkeleyensis* and *morroensis*, and interparietal and supra-occipital rather broad, not narrow as in *tularensis* and *swarthi*.

**Comparisons.**—*Mohavensis* shows the same pattern of coloration as in *agilis*, but differs notably as to externals in paler, lighter ochraceous-buffy tone of coloration, in much smaller ear (less than 13 mm. from crown), in grizzled instead of blackish dorsal and ventral tail stripes, and in much reduction in extent of facial dark markings. The color of the dorsum is ochraceous-buff, in some specimens tending towards pinkish cinnamon, slightly obscured with dusky on top of head, middle of back, rump, and thigh patches. The ears are lighter colored, close to tone on rump, with much white all along upper fold-over. There is a small dusky spot on the nose, which does not connect with the small isolated blackish whisker patches; the face is much paler than in *agilis*, chiefly buffy white; the light spot above the eye is pure white and large (fully 3 mm. in vertical width). The white-based area of the pelage on each side of the body extends higher than in *agilis*; it is here that the ochraceous-buff of the ends of the hairs shows clearest. However, all along the sides are to be seen on close inspection scattering very fine blackish hairs. A mixture of white hairs among the black ones of the dorsal and ventral tail stripes gives them a grizzled or pepper-and-salt appearance. There is a tendency for the ventral stripe to narrow to a vanishing point short of the end of the tail, so that the sides of the tail in *mohavensis* look whiter towards the end; but the tuft and crest of the tail are distinctly dusky—no trace of a true white tip. The patches on the soles of the hind feet are drab rather than distinctly black.

The extreme "squarish" type of skull, of course, sets *mohavensis* far apart from all members of the *agilis* group. This squarish shape results from the great spread of the maxillary arches; in fact this dimension is almost as great as "breadth of skull across bullae." In

the "narrow-faced" species, in contrast with this "broad-faced" type, the skull in dorsal view narrows anteriorly in wedge shape.

From its rather closely related neighbor *tularensis*, separated from it, however, by a sharp barrier comprised in the Upper Sonoran and Transition mountain ranges lying between the San Joaquin Valley and the Mohave Desert, *mohavensis* differs in paler tones of color, in decidedly less blackish on face and tail, in much smaller ear, in far smaller bullae (hardly half the volume of those in *tularensis*), and much wider supra-occipital and interparietal. These differences hold in the aggregate in any one specimen absolutely, so that there is no question that full specific status should be employed for *mohavensis* in so far as *tularensis*, as well as the other subspecies of *heermanni*, is concerned.

*Variations*.—Seven specimens from the Providence Mountain region, extreme eastern San Bernardino County, have skulls showing, in comparison with topotypes of *mohavensis*, larger mastoid bullae, more inflated posteriorly. These skulls are close to *panamintinus* in size, but the mastoid bullae average more rotund, less flattened postero-externally. The skins are constantly and considerably different from *panamintinus*, but are not distinguishable from typical *mohavensis*, save that the dimensions average slightly greater. With the material so far available there is not sufficient ground for naming a Providence Mountain race.

Young of *mohavensis*, in juvenile pelage, are like adults but are decidedly paler. They have a "washed-out" appearance, due to extreme reduction of dark markings which results in lesser degree of contrast. The color tone of the upper surface is close to light buff, and the basal portion of the pelage down the mid-dorsum is gull gray. Juveniles up to the time of the post-juvenile molt can be told instantly from adults by the shortness of the hairing at the end of the tail.

*Measurements*.—Ten selected adult specimens, 5 males and 5 females, all from the immediate environs of Mohave, Kern County, give average and extreme measurements, in millimeters, as follows: total length, 290 (285–300); tail vertebrae, 167 (156–175); hind foot, 43.7 (42–45); ear from crown, 10.3 (9–11); greatest length of skull, 39.3 (38.5–41.4); breadth of skull across bullae, 23.9 (23.2–24.8); spread of maxillary arches, 23.2 (22.2–23.7); greatest length of nasals, 14.8 (14.1–16.4); greatest width of rostrum near end, 3.9 (3.6–4.2); width of maxillary arch at middle, 5.5 (4.9–5.9).

Weight, in grams, of ten adults, 5 males and 5 females, from same locality, taken March 12 to 16: 75.8 (65.8–85.6).

*Type locality*.—Altitude 3275 feet, half mile east of railway station of Warren (about five miles north of Mohave), Kern County, California (Grinnell, 1918, p. 428). Type collected by J. Grinnell, March 27, 1917; now no. 26835, Mus. Vert. Zool.

*Distribution area*.—The Mohave Desert region, north into the lower end of Owens Valley as far as the vicinity of Lone Pine, south into Antelope Valley, in extreme northern Los Angeles County, and to Hesperia, San Bernardino County, east through the Providence and New York mountains, and west over the Walker and Kelso passes into the Kern River basin as far as Isabella, Kern County. (See map, fig. T.) Altitudinal range, 2500 to 5500 feet. Life-zone, Lower Sonoran, in its upper portion.

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Inyo County: vicinity of Lone Pine Creek, 4500 feet, near Lone Pine, 15; Carroll Creek, at 5500 feet, 1; Olancha, 3645–3900 feet, 4; Little Lake, 3150 feet, 8. Kern County: Little Dixie Wash at 3174 feet, 2; Freeman Cañon, east slope Walker Pass, at 4900 feet, 6; west slope Walker Pass, at 4600 feet, 16; Onyx, 2750 feet, 18; Weldon, 2650 feet, 17; Fay Creek, at 4100 feet, 1; Isabella, 2500 feet, 3; head of Kelso Creek Valley, 3500–5000 feet, 8; Redrock Cañon at 3500 feet, 1; Warren Station, 3274 feet, 13; Mohave, 2800 feet, 19; seven miles west of Mohave, 2 (in coll. A. B. Howell). Los Angeles County: near Fairmont, 2800 feet, 8; Lancaster, 1 (in coll. Stanford Univ.). San Bernardino County: Hesperia, 8 (coll. D. R. Dickey); "Chico Spring," Providence Mountains, 1; Purdy, 4500 feet, six miles south-east of New York Mountains, 7. Total number of specimens examined, 159.

### **Dipodomys leucogenys** (Grinnell)

#### Pale-faced Kangaroo Rat

(Pl. 4, fig. 22; text-figs. S, T)

*Perodipus leucogenys* Grinnell (1919a, p. 46) [orig. descr.].

**Diagnosis.**—Similar to *mohavensis*, but slightly larger and darker colored; tail more heavily haired, with crest extending nearly or quite halfway toward base; skull showing slightly heavier rostrum, broader supra-occipital, and heavier dentition. The light cheek areas in *leucogenys* are very pale, grayish white, not distinctly buffy whitish as in *mohavensis* and most other species.

**Comparisons.**—The darker tone of coloration of *leucogenys* as compared with *mohavensis* consists in the presence of more dusky hair-tipping in the former, and this hair-tipping extends clear down on the sides to the line limiting the white of the lower surface; also the ground color is pinkish buff in tint rather than ochraceous-buff. The eyelids, nose, and ears are more deeply or extensively blackish, and with the latter there is more contrast between the white along upper fold-over and at forward base, and the deeply dusky balance of the ear. The tail is even more predominantly white than in *mohavensis*; the increased hairing is chiefly white, though there is left a dorsal fringe of light drab which involves also the entire end of the terminal tuft. The actual greater size of the hind foot of *leucogenys* is accentuated in comparison with *mohavensis* by the heavier pelage, especially as enveloping the toes beneath; in other words, the sole of the foot is more heavily padded.

*Leucogenys* differs from *panamintinus* as follows: less black or dusky and more white about face and ears (white spot above eye larger, cheek whiter, light area on upper folded-over rim of ear more extensive and clearer white, dark facial marking less distinctly black, and broken on each side between nose and whisker spot); white flank stripe broader; tone of dorsal coloration paler, more pinkish buff, with less of dusky intermixture or over-wash down middle of back; tail more heavily crested; white side-stripes of tail broader and dark

dorsal and ventral stripes correspondingly narrower, the latter playing out short of tip of tail; feet (in fall specimens at least) more densely haired.

*Toes.*—The claw on first<sup>\*</sup> toe of the hind foot is normally present in all specimens examined except two. No. 24091, adult male, from Dry Creek near Mono Lake, shows a mere rudiment of this claw on the right foot, while on the left foot it is abnormally large. In no. 26912, male adult, from near Benton, the first claw on the right hind foot is present only as a very small callosity.

*Measurements.*—Ten selected adult and subadult specimens, 5 males and 5 females, from the vicinity of Benton, Mono County, show average and extreme measurements, in millimeters, as follows: total length, 301 (293–312); tail vertebrae, 176 (168–182); hind foot, 45.2 (44–48); ear from crown, 12.4 (11–14); greatest length of skull, 40.4 (39.5–41.3); breadth of skull across bullae, 24.3 (23.3–25.0); spread of maxillary arches, 23.2 (22.6–24.0); greatest length of nasals, 15.4 (15.1–15.9); greatest width of rostrum near end, 4.4 (4.3–4.6); width of maxillary arch at middle, 5.4 (5.0–5.9).

Weight, in grams, of ten adults, 5 males and 5 females, from same locality, taken September 6 to 21: 80.0 (70.5–88.5).

*Type locality.*—Pellisier Ranch, 5600 feet altitude, five miles north of Benton Station, Mono County, California (Grinnell, 1919a, p. 46). Type collected by Joseph Dixon, September 20, 1917; now no. 26933, Mus. Vert. Zool.

*Distribution area.*—The territory lying southeast of Mono Lake and in the head of Owens Valley, thence southward, along the west side of Owens Valley, as far as the vicinity of Independence. Altitudinal range, 3900 to 7300 feet. Life-zone, Upper Sonoran and, at least at the north, Transition. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Mono County: Mono Mills, 7300 feet, 10; Dry Creek, 6700–6900 feet, near Mono Lake, 3; Mono Craters, 6600–7100 feet, 3; Pellisier Ranch, 5600 feet, five miles north of Benton Station, 12; Benton, 5639 feet, 6; Taylor Ranch, 5300 feet, two miles south of Benton Station, 29. Inyo County: Farrington Ranch, 4100 feet, west of Laws, 9; nine miles west of Bishop, 4 (in coll. A. B. Howell); Walters Ranch, 3900 feet, two miles north-northwest of Independence, 19. Total number of specimens examined, 95.

### **Dipodomys panamintinus** (Merriam)

#### **Panamint Kangaroo Rat**

(Pl. 4, fig. 24; text-figs. D, I, R, S, T)

*Perodipus panamintinus* Merriam (1894, p. 114) [orig. descr.]; and, in part at least, of authors generally.

*Cricetodipus panamintinus*, Trouessart (1897, p. 581).

*Diagnosis.*—A rather large sized, normally five-toed kangaroo rat, with general coloration darkest of all the species living in California east of the desert divides. Coloration but slightly paler than in *agilis*.

Ear middle-sized. Skull of broad-faced type, quite like that of *heermanni* or *goldmani* but broader, with heavier rostrum and much larger teeth; bullae moderately inflated, about as in *goldmani*.

*Comparisons.*—*Panamintinus* is so remarkably like *agilis* in external appearance, that the detailed description of the latter (given on p. 87) will suffice for the former as well, save that the ear is much smaller in *panamintinus*, and the general dimensions and weight are greater. Close comparison of series shows that the cheeks in *panamintinus* average whiter and the lateral white tail stripes broader, but the dark markings everywhere are almost as bold. As indicated by the skull, however, *panamintinus* has nothing to do with *agilis*, but clearly shows its alliance with *heermanni*.

From its neighbor *leucogenys*, *panamintinus* differs in less hairy tail, slightly larger bullae, weaker rostrum, and decidedly darker coloration: In the latter regard, the solidly blackish arietiform facial marking is alone diagnostic. The light cheek patches are much obscured with dusky; the white spot above eye is smaller; the grayish white patch at tip of upper fold of ear is smaller, and the white at base of ear is less extensive; the white band across the thigh is narrower; the ankles and soles of hind feet are blackish; the white side-stripes of tail are narrower, and the dorsal and ventral stripes are correspondingly broader and also lack in large part the grizzling due to intermixture of white hairs, or bases of hairs, with the black.

*Panamintinus* is even more different from *mohavensis*. It is larger (especially as regards ear) and decidedly darker in general coloration; the nose and whisker patches are deeply blackish and run together to form a nearly or quite solid arietiform figure as viewed from the front. The skull averages broader than in *mohavensis*, with much larger mastoid bullae and heavier teeth. In the large series of these two forms at hand there is not one adult specimen that can not be named at a glance. The ranges of the two so far as known do not meet, and they occupy wholly different life-zones. *Leucogenys* is intermediate in some respects between *panamintinus* and *mohavensis*, but it has some features all its own, and no proof of intergradation is as yet forthcoming. Therefore full specific status is given here to all three forms.

*Toes.*—All the specimens at hand show the claw of the hallux present and of normal size except one. No. 26886, female adult, from the northern Panamint Mountains, lacks the first claw on the right hind foot, and that on the left foot though present is abnormally small.

*Measurements.*—Ten selected adult specimens, 5 males and 5 females, all from the vicinity of Jackass Spring, in the northern section of the Panamint Mountains, show average and extreme measurements, in millimeters, as follows: total length, 299 (290–315); tail vertebrae, 173 (160–180); hind foot, 44.4 (43–45); ear from crown, 13.6 (12–15); greatest length of skull, 40.5 (39.4–42.0); breadth of skull across bullae, 24.8 (24.0–26.3); spread of maxillary arches, 23.6 (22.5–24.7); greatest length of nasals, 15.4 (15.0–16.3); greatest width of rostrum near end, 4.2 (4.0–4.5); width of maxillary arch at middle, 5.7 (5.4–6.1).

Weight, in grams, of the same ten specimens, five of which were taken June 24 to 26 and five October 1 to 4: 79.1 (70.0–90.1).

*Type locality*.—Panamint Mountains, California, on head of Wil-low Creek (Merriam, 1894, p. 114). On the U. S. G. S. map, Ballarat Quadrangle, edition of March, 1913, this is probably at about 6200 feet altitude, some 3 miles northeast of Jackass Spring. Type collected by Edward W. Nelson, May 12, 1891; now no.  $\frac{28566}{40670}$  Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 61).

*Distribution area*.—The highest parts of the northern section of the Panamint Mountains, in the vicinity of Jackass Spring. Area of known habitat about 6 by 8 miles. Altitudinal range, 6000 to 7000 feet. Life-zone, Upper Sonoran and lower edge of Transition. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Inyo County: Panamint Mountains: one mile south of Lee Pump, 6100 feet, 5; three miles northeast of Jackass Spring, 6200–6500 feet, 48. Total number of specimens examined, 53.

### **Dipodomys stephensi** (Merriam)

#### Stephens Kangaroo Rat

(Pl. 4, fig. 23; pl. 6, fig. 45; text-figs. Q, S, T)

*Perodipus stephensi* Merriam (1907, p. 78) [orig. descr.]; and of authors.

*Diagnosis*.—A five-toed, middle sized member of the *heermanni* group. In general coloration and size almost identical with *agilis*; differs externally mainly in small size of ear (less than 13 mm. from crown). Skull of broad-faced type; similar to that of *panamintinus*, but rostrum slenderer, teeth weaker, interparietal and supra-occipital narrower; bullae more globular in shape, and also decidedly deeper dorso-ventrally as viewed from behind. Differs more or less from all other kangaroo rats in this extreme globose shape of bullae.

*Comparisons*.—*Stephensi* has been caught in the same trap-line with *agilis* without any notion on the part of the trapper that two species were represented. The chief external difference lies in the much smaller ear of *stephensi*. The tone of dorsal coloration is slightly paler buffy, particularly along the sides; but this difference is not readily appreciable except upon comparison of series. Cranially these two species are widely different; *stephensi* has a much broader skull, the spread of the maxillary arches and the width of the skull across the bullae both being greater, and the maxillary arches themselves are decidedly wider and more prominently angled.

The globular shape of the bullae as viewed from above is the feature of *stephensi*, not only as compared with *agilis*, but also in comparison with other members of the *heermanni* group. Analyzed, this consists in lesser diagonal length of each mastoid bulla in *stephensi*, together with greater width of same; in other words the bullae tend to swell out postero-externally. Also the suture between the parietal and mastoid on each side is more curved (forward), less straight. The depth of the bullae is conspicuously greater in *stephensi*.



than in *mohavensis* or *panamintinus*; it is more as in *jolonensis*, though the bullae are decidedly less in general volume than in the latter.

*Stephensi* is nearer like *panamintinus* than any other form east of the desert divides. In fact, as to externals, these two species are almost indistinguishable. *Stephensi* has slightly the smaller ear, perhaps, and a trifle less of dusky overwash on the dorsum. *Stephensi* is much darker colored than *mohavensis*; all the dark markings are more extended and the light areas correspondingly more reduced.

*An anomaly*.—No. H850, collection of Donald R. Dickey, taken by Laurence Huey five miles northeast of Bonsall, San Diego County, October 30, 1920, is unique in certain features. Indeed, it is so far divergent from any described species that I prefer to leave it unplaced until further material from that locality can be obtained. It is a female, immature (probably  $\frac{4}{5}$  grown), with the post-juvenal molt in progress, and with collector's measurements as follows: length, 260 mm.; tail, 160; hind foot, 42; ear, 12. Six other kangaroo rats taken at the same time and place are all unequivocally *simulans*, that is, therefore, of the *agilis* group.

The specimen in question shows a decidedly paler tone of body coloration (light wood brown) than *simulans* and its ear is smaller, closely approaching in these respects *stephensi*, or rather to what it is judged *stephensi* would show at the same age, there being no comparable examples of the latter at hand. The facial arietiform mark is solidly black, and the eyelids are conspicuously black. The dorsal gland is highly developed and its location is marked by a blackish spot. The dusky sole stripe is normal for *stephensi*. The really extraordinary thing about the animal is its solidly black or sooty black tail, continuously so from the narrow whitish basal ring clear to the tip. There is not a trace of white side-stripes or of a lighter core to the tuft. The tuft and crest, however, are not fully developed, showing the degree of scantiness usual in immatures.

The only known species of *Dipodomys* in which the tail even approaches the continuously black coloration of this specimen is *morroensis*. And in the blackest immature of that species there is still a clear indication of white side-stripes.

The skull of the animal under consideration is obviously not fully grown, but as compared with *simulans* and *agilis* of similar age, it shows much greater depth posteriorly, the bullae higher, and with steeper sides outwardly and with somewhat more globular mastoid inflations as viewed dorsally; incisors less incurved. The maxillary arches do not spread particularly widely, but they are broad and prominently angled. In most of these cranial characters, one is strongly reminded of *stephensi*, of the *heermanni* group. The more important cranial measurements are as follows: greatest length of skull, 36.6 mm.; breadth of skull across bullae, 23.6; spread of maxillary arches, 20.5; greatest length of nasals, 12.8; width of rostrum near end, 4.1; width of maxillary arch at middle, 5.6. It must be kept in mind in considering these measurements that the usual proportions are present due to immaturity.

Taking all the characters together this puzzling specimen resembles *stephensi* most nearly, but the black tail and narrow spread of maxillary arches set it off too far to warrant listing it flatly with that

species. It may be a mere "sport" (mutant?) derived from *stephensi*, less likely *simulans*, parentage, or it may represent a well established species or subspecies as yet unknown. If this specimen really is referable to *stephensi* it carries the known range of the species some twenty-five miles south of the limits shown on the map (fig. T).

*Measurements.*—Ten adult and subadult specimens, 9 males and 1 female, from the region between Riverside and San Jacinto, show average and extreme measurements, in millimeters, as follows: total length, 291 (277–300); tail vertebrae, 172 (164–180); hind foot, 42 (41–43); ear from crown, 12 [only one of the specimens measured fresh, but comparison of the dried ears indicates close to the same dimension throughout]; greatest length of skull, 39.4 (38.3–40.6); breadth of skull across bullae, 25.1 (24.3–25.6); spread of maxillary arches, 22.5 (21.0–23.8); greatest length of nasals, 14.2 (13.7–14.8); greatest width of rostrum near end, 4.0 (3.8–4.4); width of maxillary arch at middle, 5.6 (5.1–6.0).

Weights are not available for this species; but figuring from relative length of body on the basis of known weights in other species, *stephensi* weighs on an average about 74 grams.

*Type locality.*—San Jacinto Valley, Riverside County, California (Merriam, 1907, p. 78); more exactly, a little west of the present town of Winchester, towards Menifee (F. Stephens, in letter dated September 22, 1920). Type collected by Frank Stephens, November 27, 1885; originally no. 1808, C. H. Merriam coll.; now no. 186503, in U. S. National Museum (*vide* A. H. Howell, in letter of September 29, 1920).

*Distribution area.*—San Jacinto Valley and vicinity, western Riverside County and extreme southern San Bernardino County. Altitudinal range, 1100–1600 feet. Life zone, Lower Sonoran. (See map, fig. T.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Riverside County: Alessandro Valley at 1600 feet, seven miles southeast of Riverside, 5; Riverside (that is, seven miles southeast), 4 (U. S. Biol. Surv. coll.); six miles northwest of San Jacinto, 2 (U. S. Biol. Surv. coll.); Temescal, 3 (in coll. Stanford Univ.). San Bernardino County: Reche Cañon at 1250 feet, four miles southeast of Colton, 1. Total number of specimens examined, 15.

### ***Dipodomys ingens* (Merriam)**

#### **Giant Kangaroo Rat**

(Pl. 4, fig. 25; text-figs. A, B, C, J, R, S, X)

*Perodipus ingens* Merriam (1904, p. 141) [orig. descr.]; and of authors.

*Diagnosis.*—A very large sized, five-toed, broad-faced kangaroo rat of almost exactly the coloration of *tularensis*. Length of head and body alone usually more than 135, of hind foot 48 to 55; ear, relatively to size of body, small; tail relatively short. Skull very broad, massive,

with widely spreading maxillary arches; bullae rather large, rounded; interparietal and supra-occipital narrow; jugal bars stout; dentition heavy.

*Comparisons.*—Size, alone, distinguishes this kangaroo rat from all other Californian species except *deserti*; and *deserti* is a "4-toed" species, while *ingens* is a constantly "5-toed" species, in so far as shown by material available. Furthermore, *deserti* is extremely narrow-faced (with corresponding cranial peculiarities), while *ingens* is broad-faced. The skull of *ingens* is very broad and "squarish" in shape as viewed dorsally. The interparietal and supra-occipital are narrow, as in *tularensis*, but the mastoid bullae are relatively larger and more globular; the maxillary arches are broad, but their postero-external angles are not especially prominent; the jugal bars are notably broader and heavier throughout, as compared with any other of our kangaroo rats. The dentition is likewise notably heavy.

In proportions of body and limbs, *ingens* seems to be quite typical of kangaroo rats in general. The tail, however, is relatively short. The ear is relatively small; though actually somewhat larger than in any other member of the *heermanni* group, it does not quite reach the size in *agilis* and related forms. The great general size of *ingens*, upon comparison with other kangaroo rats of its general region, is seen to involve conspicuous thickness of tail, breadth as well as length of hind foot, and stoutness of claws and toes on front foot.

In coloration *ingens* conforms closely to *agilis* in pattern, but is paler, almost exactly as in *tularensis*, with which form it is associated in part of its range. The dusky nose and whisker patches are not ordinarily connected to form a continuous marking; the cheeks are whitish, paler than in *agilis*, but the eyelids are fully as conspicuously blackish; the sides of the body, that is, the area in which the basal parts of the pelage are pure white, are clear warm buff, with only fine blackish hairs scattered here and there; the rump and thigh patches are rather heavily "washed" with dusky, giving a slightly darker effect than usually obtains in *tularensis*; the soles of the hind feet are drab; the tail markings are quite as in *tularensis*.

*Variations with age.*—The young of *ingens* are paler than adults, the tone of body color being light buff rather than warm buff. The dark markings of face and ears are duller, but the terminal dark parts of the tail are darker, approximately fuscous-black. Young less than half the bulk of adults are yet easily distinguishable from any other *Dipodomys* of western California because of the huge hind foot. For example, a juvenile female (no. 14451) taken at McKittrick, Kern County, May 18, 1911, shows the following measurements, in millimeters: total length, 256; tail vertebrae, 145; hind foot, 48; ear from crown, 10. The young of *deserti*, of about the same size, differ externally from young *ingens* in lack of drab sole patch, in lack of ventral tail stripe, in presence of white tail tip, in much lighter, pale ochraceous-buff body color without dusky tippings to overhairs, and in lack of first claw on hind foot. The cranial peculiarities of *ingens* are well marked in the young but half grown, save that the maxillary arches are not so wide-spreading and the supra-occipital and interparietal are not so narrow.

*Relationships.*—*Dipodomys ingens*, on the ground of its "square" type of skull, with the numerous associated cranial features, appears to the writer to belong within the *heermanni* group, and to be not so very far distant from *tularensis*. It is certainly much more remote in its relationships with the *agilis-elephantinus* series or with *deserti*. The globular shape of the mastoid bullae recalls the condition in *stephensi*, but this may not be at all significant of any near relationship. On the whole, *ingens* seems to stand well apart as an exceptionally "good" species, but not far enough to constitute a "group" by itself.

*Measurements.*—Eight adult or subadult specimens, 2 males and 6 females, from McKittrick and Cuyama Valley, give average and extreme measurements, in millimeters, as follows: total length, 329 (311–347); tail vertebrae, 185 (174–198); hind foot, 50 (48–55); ear from crown, 13 [this is estimated from dry skins]; greatest length of skull, 44.6 (43.3–46.6); breadth of skull across bullae, 29.0 (27.9–30.3); spread of maxillary arches, 26.5 (26.2–27.4); greatest length of nasals, 16.5 (15.8–17.5); greatest width of rostrum near end, 4.9 (4.5–5.2); width of maxillary arch at middle, 5.9 (5.6–6.2).

There are no weights available for this species; but an estimate based on average body length shows a probable average weight of 105 grams.

*Type locality.*—Painted Rock, "20" [= 12] miles southeast of Simmler, Carrizo Plain, San Luis Obispo County, California (Merriam, 1904, p. 141). Type collected by Luther J. Goldman, August 6, 1903; now no. 128805, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 60).

*Distribution area.*—A narrow strip of semi-arid, more or less level territory along the southwestern border of the San Joaquin Valley, including also the nearby Carrizo Plain and Cuyama Valley. Recorded north to mouth of Panoche Creek, in western Fresno County, and south to Cuyama Valley, in southern San Luis Obispo County and extreme northern Santa Barbara County. Altitudinal range, 500–2500 feet. Life-zone, Lower Sonoran. (See map, fig. X.)

The following localities are represented in the material examined, the number of specimens from each place also being indicated. Fresno County: Panoche Creek at 503 feet, nineteen miles southwest of Mendota, 1. Kern County: Buttonwillow, 1 (in coll. Calif. Acad. Sci.); McKittrick, 20; three miles north of Buena Vista Lake, 3 (in coll. D. R. Dickey). San Luis Obispo County: Carrizo Plain near Santiago Spring [San Diego Joe's], 4 (in coll. Calif. Acad. Sci.); Cuyama Valley at 1900 feet, 2. Total number of specimens examined, 31.

**Dipodomys ordii columbianus** (Merriam)

## Columbian Kangaroo Rat

(Pl. 4, fig. 27; text-figs. S, U)

*Perodipus ordi columbianus* Merriam (1894, p. 115) [orig. descr.].*Perodipus columbianus*, Grinnell (1919a, p. 47).

**Diagnosis.**—A small sized, five-toed, rather broad-faced kangaroo rat, of cinnamon-buff general coloration, and with blackish ears and facial markings. Maxillary arches rather broad and wide-spreading; supra-occipital and interparietal broad, so that mastoid bullae are widely separated; rostrum stout; bullae moderately inflated; incisors strongly in-curved.

**Descriptive notes.**—The tail is relatively short (averaging only 126 per cent of head and body) and crested two-fifths the way from tip to base; tuft and crest deep mouse gray; blackish dorsal tail stripe a little wider than white lateral ones; white lateral and ventral dusky stripes of equal width. Sole stripe mouse gray. The ear is small (about 10 mm. from inner base) and is clothed with blackish hairs, except for white ones on rim and tip of upper fold-over; forward basal fold-over white. Spot over eye and patch at hinder base of ear conspicuously pure white. Arietiform facial mark distinct, blackish, narrow but complete.

A juvenile specimen (no. E413, coll. D. R. Dickey) is remarkably like adults in general coloration; the dorsal tone is between light buff and warm buff, the sides clearest, the mid-dorsum washed with dusky; the dark facial markings are less sharply indicated than in adults, the ear is smaller, and the tail is relatively shorter, with hairing much less full.

**Comparisons.**—*Columbianus* and the related subspecies *monoensis* are the Californian representatives of the *ordii* group, which group ranges widely elsewhere, through the Rocky Mountain and Great Basin regions (Goldman, 1917, p. 113). There are nine or more forms in the group, the first of which to be named, *Dipodomys ordii* Woodhouse, was described from El Paso, Texas. The two Californian members of the *ordii* group are, by reason of their small size, likely to be confused only with members of the *merriami* and *microps* groups. The first toe on the hind foot, in the *ordii* group, is a good external character for separation from any of the *merriami* group, because in all the material available it is constant. Also, for *columbianus*, the color of the ear is diagnostic—blackish or at least dusky as compared with flesh-colored (because of scantiness of hairing) in the subspecies *merriami* at least. The tail is relatively shorter in the former. Cranially, *columbianus* can be distinguished from *merriami* and the near relatives of the latter by the greater breadth of the interparietal and supra-occipital, by the heavier rostrum, and by the narrower frontal width so that the jugals appear in dorsal view well apart on either side.

*Columbianus* resembles *levipes* very closely in almost every detail of coloration, but the general size of the former is much less. As regards cranium, aside from size, the great width of supra-occipital and interparietal is diagnostic, as also the much more in-curved incisors, the greater width of the maxillary arches, and the sharper angulation of the same.

From *microps*, *columbianus* differs notably as to externals only in darker tone of coloration; but cranially, important differences consist in the heavier rostrum of the latter, more in-curved incisors, broader supra-occipital and interparietal, and much broader and more sharply angled maxillary arches. In the latter regard, *columbianus* (and its relative *monoensis*) presents the broad-faced type of structure, while *microps* and *levipes* are narrow-faced.

*Measurements*.—Eight adult and subadult specimens, 5 males and 3 females, from Vinton, Plumas County, give average and extreme measurements, in millimeters, as follows: total length, 233 (228–240); tail vertebrae, 130 (127–135); hind foot, 38 (35–40); ear from crown, 10 (9–12); greatest length of skull, 35.6 (35.1–36.3); breadth of skull across bullae, 22.5 (22.2–22.8); spread of maxillary arches, 19.3 (18.7–19.8); greatest length of nasals, 13.1 (12.7–13.5); greatest width of rostrum near end, 3.4 (3.3–3.5); width of maxillary arch at middle, 4.0 (3.9–4.1).

Weights for this species are not available. But an estimate based on body length shows a probable average weight of 44 grams.

*Type locality*.—Umatilla, Plains of Columbia, Oregon (Merriam, 1894, p. 115). Type collected by C. P. Streater, October 18, 1890; now no. <sup>24181</sup><sub>31594</sub> Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 60).

*Distribution area*.—The species belongs to the northern portion of the Great Basin area of the western United States, and might be expected to occur generally over the lower sagebrush levels in the elevated northeastern corner of California. But only one locality within this state is represented in the material as yet available: Vinton, 4700–5000 feet altitude, Plumas County, 12 specimens (6 in coll. D. R. Dickey, 2 in coll. A. B. Howell). Life-zone, Upper Sonoran. (See map, fig. U.)

### ***Dipodomys ordii monoensis* (Grinnell)**

#### **Mono Kangaroo Rat**

(Pl. 1, fig. 4; pl. 4, fig. 26; text figs. R, S, U)

*Perodipus monoensis* Grinnell (1919a, p. 46) [orig. descr.].

*Diagnosis*.—Of the general characters of *columbianus*, but coloration decidedly paler, dark markings more restricted, white extended; dorsal dark tail stripe not wider than lateral white stripes; ventral tail stripe much narrower than lateral ones and pale mouse gray in color. Skull with mastoid bullae more inflated and projecting farther backward so as to leave a deeper occipital cleft.

*Comparisons.*—*Monoensis* is one of the palest colored kangaroo rats in California, approaching closely in degree of pallor *simiolus*, *microps* and even *deserti*. The dorsal color tone in *monoensis* is close to pinkish buff, clearest along the sides where also the white of the basal portions of the hairs shows through high up above the lateral line; the dorsal dusky wash is very faint, the dusky of the ears is weak-toned, and the main facial marking is reduced to a dusky spot on the nose, usually without any trace of lateral extensions to bases of whiskers; the dark stripes on tail are reduced in width and in depth of color.

Externally *monoensis* is astonishingly like *microps* which, towards the head of Owens Valley, occurs as a very close neighbor. The differences in measurements and coloration are only average. But the skulls are conspicuously and constantly different in the respects set forth under *columbianus*. *Merriami* is also a near neighbor and being of small size might also be confused with it. But *merriami* as far as known invariably lacks the first claw on the hind foot, has a relatively longer tail than in *monoensis*, a paler, flesh-colored ear, and the skull is constantly different in the same respects as set it off from *columbianus*.

*Measurements.*—Ten adult specimens, 5 males and 5 females, all from the vicinity of Benton, show average and extreme measurements, in millimeters, as follows: total length, 233 (220–245); tail vertebrae, 125 (120–137); hind foot, 38.7 (38–40); ear from crown, 11 (10–12); greatest length of skull, 36.9 (35.9–37.8); breadth of skull across bullae, 23.3 (22.6–24.2); spread of maxillary arches, 19.9 (19.3–20.2); greatest length of nasals, 13.7 (13.4–14.4); greatest width of rostrum near end, 3.5 (3.2–3.8); width of maxillary arch at middle, 4.3 (4.0–4.7).

Weight, in grams, of the same ten examples, all of which were taken during the period from August 28 to September 21: 45.8 (40.0–50.2).

*Type locality.*—Pellisier Ranch, 5600 feet altitude, five miles north of Benton Station, Mono County, California (Grinnell, 1919a, p. 46). Type collected by J. Dixon, September 21, 1917; now no. 27002, Mus. Vert. Zool.

*Distribution area.*—The sagebrush flats at the extreme head of Owens Valley. Altitudinal range, 5300–5640 feet. Life-zone, Upper Sonoran. (See map, fig. U.)

The following are the localities represented by the 14 specimens examined. Mono County: Pellisier Ranch, 5600 feet, five miles north of Benton Station, 11; Benton, 5640 feet, 1; Taylor Ranch, 5300 feet, two miles south of Benton Station, 2.

**Dipodomys merriami merriami** Mearns

## Merriam Kangaroo Rat

(PL 2, fig. 9; pl. 6, fig. 39; text-figs. E, O, S, U, V)

*Dipodomys merriami* Mearns (1890, p. 290) [orig. descr.]; and of some authors, at least in part.

*Dipodomys merriami nitratus* Merriam (1894, p. 112) [orig. descr.]; and of authors.

*Dipodomys merriami mortivallis* Elliot (1903, p. 250) [orig. descr.]; and of authors.

*Dipodomys merriami simiolus*, Mearns (1897, p. 720), part; and, in part, of several authors.

*Dipodomys merriami kernensis* Merriam (1907, pp. 77-78) [orig. descr.]; and of authors.

*Dipodomys merriami nevadensis*, Grinnell (1913, p. 341).

*Dipodomys merriami merriami*, Grinnell (1914, pp. 241-243), part.

**Diagnosis.**—A small sized, four-toed, buff colored kangaroo rat; ventral as well as dorsal tail stripe normally present, and tail tuft dusky to end; dusky facial markings and dusky sole stripe usually present, though pale. Skull of broad-faced type, with wide and sharply angled maxillary arches; rostrum relatively slender; bullae variable but usually rather more inflated than in other species of similar general size; mastoid bullae not touching, plenty of room being left between for supra-occipital and interparietal, though these are not so wide as in some species.

**Pelage.**—Of silky "feel," as in most other desert members of the genus; just about an average as regards quantity and distribution. Length of longer hairs in new coat: on rump, 18 millimeters; on top of head, 9.5; on belly, 10; on chin, 4. Longest vibrissae, 55 mm. Tail with tuft and crest full, latter extending back two-fifths distance from tip to base of tail. Longest hairs of terminal tuft, 24 mm. long.

**Coloration.**—In adult in fresh pelage: distribution of silky white and of dark tones closely similar to that in *agilis* and most other species. Upper surface light ochraceous buff slightly over-washed with dusky in mid-dorsal region; parting of the pelage discloses extensive "neutral" coloration basally, close to dark gull gray; hairs on lower sides, white at base. Arietiform facial marking distinct, dusky, consisting as usual of coalesced nose and whisker patches. Eyelids dusky. Cheeks whitish. Spots above eye and at lower base of ear, white. Ear scantily haired, usually flesh-colored, not sharply set off into white and dark areas. Dorsal and ventral tail stripes both distinct, dusky; ventral one narrowing to almost nothing towards base of terminal tuft; dark dorsal one about same in width as each of the two white lateral stripes. Crest and tuft blackish brown, the hairs whitening at bases. Sole of hind foot, from heel to ends of metatarsals, blackish brown.

**Comparisons.**—*Dipodomys merriami*, including all its subspecies, is so definitely smaller than most species of the genus occupying the



same areas with it, that this criterion alone serves to discriminate it, even with extremes of size in hand. Then, so far as now known, *merriami* definitely and invariably lacks the first toe and claw on the hind foot, so that the regularly five-toed species even when of small size, as in the cases of *microps* and *monoensis*, are separable with fair safety on this ground alone. There is still a chance, however, that some individuals of the forms just named may lack the first claw, in which cases there would be need of falling back upon other characters.

*Merriami* occurs on common ground with *microps* on certain parts of the Mohave Desert and in Owens Valley, and the two are very closely alike in size and external appearance. Indeed, with certain picked examples of the two I am unable to find any decisive external characters to distinguish them, save for the absence of first claw and for the slenderer tail in *merriami*. But skulls are absolutely different: *microps* has the very narrow, weakly angled type of maxillary arch, while *merriami* has the broad strongly angled type; in other words *microps* is "narrow-faced" and *merriami* is "broad-faced." Another good character lies in the relatively much narrower (weaker) and more in-curved incisor teeth in *merriami*.

*Levipes*, which is found in some parts of Inyo County on the same ground with *merriami*, differs from the latter in the same ways as does *microps*. In addition, there is the much darker, less brightly buffy tone of coloration of *levipes*, with blacker dark markings on face and tail, and also the decidedly larger general size of *levipes*. (Consult the statements of measurements for each of these species for extreme figures, as well as the table of comparative sizes based on averages.)

Between *merriami* and *monoensis*, which two races have not as yet, however, been found in the same locality, there are less obvious differences than in the other cases just referred to. In comparison, externally, besides possessing the first claw, *monoensis* is paler, less deeply buff, in color, and has smaller ear, thicker tail, and broader hind foot. The skulls of the two are remarkably alike in general appearance in that both are "broad-faced," and the amount of bullar inflation is about the same. But good, though "small," characters remain: *monoensis* shows heavier rostrum, broader nasals, broader interparietal and supra-occipital, frontal region narrower (so that jugal bars show from above on each side well apart from edges of supra-orbital "bead"), and heavier incisors.

*Columbianus*, being in main characters close to *monoensis*, shows much the same differences in comparison with *merriami*. Because of the darker tone of color of *columbianus*, however, it is wonderfully like typical *merriami* in external appearance at first glance. Smaller and blacker ear and blacker facial markings obtain, in addition to the features of structure set forth for *monoensis*.

For the differences distinguishing *D. merriami merriami* from the other subspecies of *merriami* reference must be made to the respective descriptions.

*Variations*.—The range of individual variation in *Dipodomys m. merriami* is considerable, seemingly greater than in any other species or subspecies of the genus. This impression may be due in some measure perhaps to the greater number of specimens of *merriami*

at hand for study. Still, in a series of but 25 or thereabouts from any one locality and taken at the same season, extremes are often present which are strikingly unlike in coloration—much more different from one another than are extremes in several times the number of, for example, *californicus* or *agilis*. This color variation involves extent of dusky over-wash on the dorsal surface, exact tint of the buff which pervades the whole dorsal surface, degree of distinctness of the facial dark markings, exact shade of the dark areas on the tail, and degree of development of the ventral tail stripe.

As set forth below, considerable modification of the intrinsic tones of color comes about subsequent to the growth of the new pelage in the fall. There is the modification of color, often to a conspicuous degree, presented, along toward summer, by animals which have been living in alkaline ground. There is also some fading of the dusky and buffy tones, even though kangaroo rats are rarely or never exposed to direct sunlight or even moderate daylight. Wearing off of the tips of the hairs may have some effect, as well. All features of an adventitious nature, such as are due to the causes just suggested, must of course be eliminated in employing color for specific and subspecific discrimination. Also mean condition must be ascertained and employed rather than any of the extremes.

The feature of the skull which varies most is the volume of the bullae, the mastoid bullae especially. Occasional specimens have the bullae inflated much above the average for the same locality, and accompanying this extra inflation is often an unusual lessening of the widths of the supra-occipital and interparietal. Such examples are most often old males, and the degree of inflation may be in some measure a function of age. Length of rostrum, width and sharpness of angulation of the maxillary arches, and flatness versus elevation of the roof of the brain case, are other notable features of individual or age variation in *merriami*.

*Merriami*, the subspecies, as here understood, has a very wide range for a kangaroo rat, greater than the range of any other form of *Dipodomys* belonging to California. It extends from the western edge of the Mohave Desert east to western Texas. This is simply another way of saying that over a wide extent of country the species *merriami* varies geographically so little as not to warrant recognizing subspecies of it, although outside of these limits there are recognized races.

The writer has studied a series of 58 *merriami*, contained in the collection of Stanford University, from Fairbanks and the vicinity of Fort Lowell, in southeastern Arizona. He has also examined a number of specimens from the vicinity of Phoenix. As regards cranial features no appreciable characters of any sort have been found for distinguishing these Arizona specimens from those of the Mohave Desert region of California. Nor have any size characters become apparent. But as to color, there is an appreciable paling of tone westwardly from the valley of the Colorado River, that is, if averages be considered.

Thus, the series from Victorville, on the Mohave River, is quite perceptibly brighter buffy than the southern Arizona examples or even than those from the valley of the Colorado River in the vicinity

of Needles. But the Victorville specimens are not so light-colored on an average as the Colorado Desert series, which latter are here placed under the separate subspecific name *simiolus*. Many light examples, not only from Victorville but from other points on the Mohave Desert, are quite as pale as not alone dark examples of *simiolus*, but even as average specimens of that race. And this fact might lead another student of the group to set the limits for *simiolus* farther east or north-east so as to include the Mohave Desert. But there are also darker colored individuals and even darker locality series, from the Mohave Desert. The criterion employed by the present writer is *mass* of characters, as derived not only from representations of a single locality but from all the available material from over a large extent of country. Upon this criterion, the limits of *merriami* to the west have been set as here indicated (see map, fig. U). The one character, of color tone, seems best referred to as a "tendency" at the west toward the extreme as manifested in the Colorado Desert race, *simiolus*. It does not seem helpful to place the Mohave Desert race under a separate name, because but one feature, color tone, seems to be involved, and because even with this feature, there is such great variation individually and locally.

A curious variant is no. 28573, a subadult female, taken April 11, 1918, at Olancha, Inyo County. The dorsal color in this specimen is drab-gray, becoming very weak buffy white along the sides. It looks as though the usual ochraceous pigment were lacking altogether.

*Basis of names in synonymy.*—The *Dipodomys merriami mortivallis* of Elliot (1903, p. 250) was named from Furnace Creek [Ranch], Death Valley, Inyo County. The present writer has at hand 41 skins with skulls of *merriami* from that locality. The characters offered by Elliot for distinguishment of *mortivallis* were evidently derived by comparison with *D. m. simiolus*; *D. merriami merriami* in adequate series seems not to have been resorted to. The color of tail, stated to vary "from a purplish drab to a pale russet," is not diagnostic; it depends upon age and stage of wear and discoloration. The cranial features alleged—"longer and broader nasals," greater width of parietals, and broader mastoids—simply vanish when large series are closely examined.

The *Dipodomys merriami nitratus* of Merriam (1894, p. 112), described from Keeler, on east side of Owens Lake, Inyo County, was based chiefly, in comparison with *merriami*, upon "wholly different coloration," namely a "uniform intense ochraceous or tawny buff not mixed with black-tipped hairs"; etc. As pointed out under *Dipodomys deserti*, this type of coloration is acquired adventitiously on low alkaline ground and recurs in widely separated valleys where similar conditions of alkalinity obtain. The writer has personally collected suites of similar skins in various parts of the range of *merriami*, and these illustrate the view here held. Among others, he has at hand 36 skins from Keeler. Part of these, taken in April, are of the rich coloration described by Merriam; the usual dusky or blackish markings on face, ears, soles of feet, and tail are replaced by tawny-olive or even cinnamon in some specimens. On the other hand, the specimens taken in late September are in fresh new pelage and are mostly of the normal *merriami* type of coloration. One, of critical value in

this connection (no. 27177, collected by the writer September 25, 1917), is in process of molt, and the old hair, which persists in a large patch on the rump and also on the sides of the head and the base of the tail, is of the bright "*nitratus*" type of color, contrasting strongly with the dull *merriami* color of the new portions of the pelage. It must be recalled here that in *Dipodomys* but one molt occurs each year, in the fall. The other, minor features ascribed to "*nitratus*" do not appear to be of diagnostic value when series of *merriami* from various localities and of different dates of capture are examined.

The *Dipodomys merriami kernensis* of Merriam (1907, p. 77) was described from Onyx (in the valley of the South Fork of the Kern River), near Walker Pass, Kern County. The characters given are numerous and involve size, coloration, and cranium. Twenty-two skins and skulls are at hand from the vicinity of Onyx; and after working over these in comparison with various other groups of specimens from elsewhere within the range of *D. merriami merriami* as here understood, it is the conclusion of the present writer that no good grounds obtain for the recognition of a race from the Kern Valley. It is to be borne in mind that this valley, faunally, is merely a westward-extending bay from the Mohave Desert area. The Lower Sonoran mammals in that valley are not isolated, but exist continuously to the southeastward up over the divide at the head of Kelso Creek. This divide, although higher than Walker Pass (from which it is separated by Kiavah Mountain), lies in the rain and wind "shadow" of the Piute Mountains, and to this fact are doubtless due its aridity and heat. These data were worked out by the writer during field work there in the summer of 1911. It is true that the Kern Valley series is paler colored than the average in a large series of *merriami* from south-central Arizona; but so are series from elsewhere in the western and southern parts of the Mohave Desert. As stated on another page, it seems best to handle this feature of variation as a *tendency*, in *merriami* of this general region, to vary in color towards *simiolus*.

To account for the larger number of forms of *Dipodomys merriami* which have been proposed than are admitted by the present reviser to valid standing, two things may be emphasized: (1) the great range of seasonal variation in coloration seemingly contingent in kind upon the sort of ground inhabited; (2) the great range of individual variation in degree of inflation of the bullae and those other cranial parts associated with them. As arguing against the idea that *merriami* ought to be found varying inherently as do certain five-toed kangaroo rats occurring in the same territory, it should be noted that, as already pointed out (Grinnell, 1914, p. 242), *merriami* ranges far and wide, in effect continuously, over the Colorado and Mohave deserts—over sandy valleys, hard surfaced mesas, and even stony hillsides. Because of its adaptability there has been no sequestration of colonies with resulting differentiation into subspecies capable of satisfactory definition with our present standards.

*Measurements.*—Ten adult specimens, 5 males and 5 females, from Death Valley, Inyo County, show average and extreme measurements, in millimeters, as follows: total length, 247 (235–260); tail vertebrae, 144 (130–154); hind foot, 38.5 (36–40); ear from crown, 11.0 (10–

12); greatest length of skull, 35.7 (34.6–37.3); breadth of skull across bullae, 23.0 (22.3–23.9); spread of maxillary arches, 19.2 (18.6–20.2); greatest length of nasals, 13.1 (12.4–13.8; greatest width of rostrum near end, 3.0 (2.9–3.2); width of maxillary arch at middle, 4.9 (4.6–5.0).

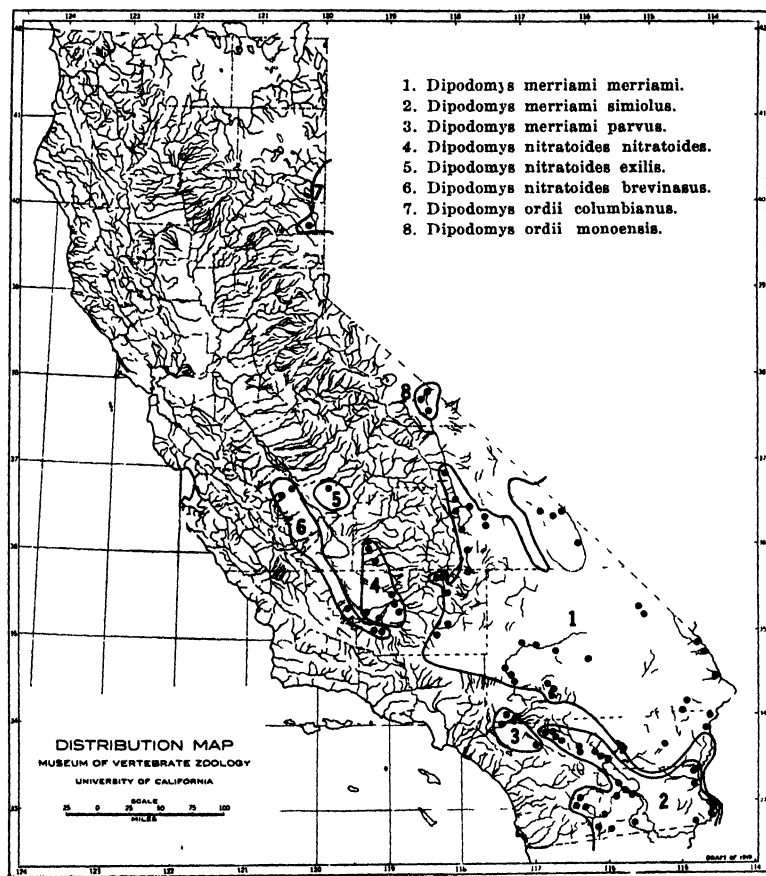


Fig. U. Map showing stations of occurrence in California of kangaroo rats of the *merriami* and *ordii* groups, as established by specimens examined by the author. Assumed general range of each form within the state outlined.

Weights, in grams, of the same ten specimens, which were taken from April 4 to April 7, were as follows: average, 40.3 (33.6–45.2).

*Type locality*.—New River [in Maricopa County, north of Phoenix], Arizona. Type collected by E. A. Mearns, May 16, 1885; male, orig. no. 194, E. A. M.; now no. 2394, Amer. Mus. Nat. Hist. (Mearns, 1890, p. 290; also skin of type examined by writer at Amer. Mus., May 21, 1921, though skull could not then be located).

**Distribution area in California.**—In general terms, the Mohave Desert region. Ranges north in Inyo County through Death Valley, and through Owens Valley as far as Independence; west, in Kern County, over the pass at the head of Kelso Creek and down into the valley of the South Fork of the Kern River as far as Weldon; south, along the Colorado River, as far as Blythe; east into Nevada and across the Colorado River into Arizona. Altitudinal range,—200 to 7000 feet. Life-zone, Lower Sonoran. (See map, fig. U.)

The following localities in California are represented in the material examined, the number of specimens from each place being also indicated. Inyo County: Independence, 34; vicinity of Lone Pine, 20; Carroll Creek at 5500 feet, 4; Keeler, 36; Olancho, 12; Little Lake, 11; Darwin, 2; fifteen miles north of Darwin, 1; Furnace Creek Ranch, Death Valley, 41; seven miles west-northwest of Death Valley Junction, 1; Kelley's Well, Amargosa Valley, 13; Shoshone, 2. Kern County: Little Dixie Wash at 3174 feet, 4; Onyx, 16; Weldon, 4; Kelso Creek Valley at 3500 feet, 2; Warren [R. R. Station], 1; seven miles west of Mohave, 1 (in coll. A. B. Howell). San Bernardino County: Barstow, 2; Daggett, 3; Newberry, 5 (in coll. A. B. Howell); five miles south of Lovie, 4; Oro Grande, 14; Victorville, 41; Hesperia, 1 (in coll. D. R. Dickey); Cushenbury Springs, 1; Cactus Flat, 6000 feet, San Bernardino Mts., 2; Doble, 7000 feet, San Bernardino Mts., 1; three miles north of Leavitt, 2; Purdy, 4500 feet, near New York Mts., 2; Horn Mine, 1000 feet, Turtle Mts., 1; Blythe Junction, 2; near Needles, 3; Colorado River opposite The Needles, 4; Chemehuevis Valley, Colorado River, 10. Riverside County: near Riverside Mountain, 5; near Blythe, 3; road towards Blythe, 53 miles east of Mecca, 1 (in coll. J. E. Law). Total number of specimens examined, 312.

### ***Dipodomys merriami simiolus* Rhoads**

#### **Allied Kangaroo Rat**

(Pl. 2, fig. 10; pl. 6, fig. 38; text-figs. E, S, U)

*Dipodomys agilis*, Baird (1857, pp. 414-415), part (†).

*Dipodomys simiolus* Rhoads (1894a, pp. 410-411) [orig. descr.]; and of some authors.

*Dipodomys similis* Rhoads (1894a, pp. 411-412) [orig. descr.]; and of a few authors.

*Dipodomys merriami simiolus*, Mearns (1897, p. 720), part; and, at least in part, of many authors.

*D[ipodomys]. m[erriami]. similis*, Elliot (1903, p. 250).

*Dipodomys merriami arenwagus*, Stone (1905, p. 679).

*Dipodomys merriami merriami*, Grinnell (1914, pp. 241-243), part.

**Diagnosis.**—Seemingly identical with *D. merriami merriami*, save for average slightly smaller general size and paler tone of coloration. Facial and caudal markings less deeply dusky and reduced in extent; color of dorsum clearer and lighter buffy, less obscured with dusky hair-tippings.

*Remarks.*—The distinctive characters of this race are developed in greatest degree on the floor of the Colorado Desert from the vicinity of Palm Springs southeast over the delta of the Colorado River. An extreme example, no. 7407, from Silsbee, Imperial County, is capucine buff on the dorsum with scarcely a trace of dusky over-wash, and is thus strikingly different in color tone from the usual type of *merriami* even from the western parts of the Mohave Desert. Then, too, in this selected specimen, the ventral tail stripe, the sole stripe, and the facial crescents are all gone; the tail is left white save for a mere indication of the dorsal stripe near the base and for about 50 millimeters of the tuft and crest which are cinnamon-drab. The white up the sides of the body, behind and below the ear, above and behind the eye, and on the cheeks is also more extensive than in *merriami*.

However, as set forth under *merriami*, individual and geographic variation both lead from this extreme manifestation to the opposite one of relatively dark coloration as well as larger size. A series of *simiolus* from Mecca contains examples as dark as the average of *merriami* from Victorville, on the Mohave Desert. It is thus a matter of averages, only, which can be employed in determining locality representations. Some of these examples, from the California side of the lower Colorado River, are so exactly between the opposite extremes of *simiolus* and *merriami* that they cannot be allocated with one or the other save by arbitrary action.

A curious individual variant is a specimen from Mecca (no. 1081) with a circular white spot some 5 millimeters in diameter in the center of the forehead.

*Dipodomys similis*, of Rhoads (1894a, p. 411), was based on nothing more than an individual variant of *D. m. simiolus*. I have examined the type (now no. 1617, Acad. Nat. Sci. Phila., female adult, skin and skull in good condition, taken by R. B. Herron at "White Water, Cal.," October 24, 1893). Specimens are at hand from the exact type locality of *similis*, Whitewater, Riverside County, and these average in all respects the same as a series from Palm Springs, the type locality of *simiolus*. It is to be noted that some of the measurements given by Rhoads for his types are unlikely for any member of the *merriami* group. These, however, were probably errors due to a slip of the pen or of proof-reading.

*Measurements.*—Ten adult specimens, 5 males and 5 females, from Palm Springs, Riverside County, show average and extreme measurements, in millimeters, as follows: total length, 240 (226–258); tail vertebrae, 145 (137–157); hind foot, 37.5 (36–40); ear from crown, 10.5 (10–11); greatest length of skull, 35.4 (34.6–36.1); breadth of skull across bullae, 22.3 (21.6–22.8); spread of maxillary arches, 18.7 (18.1–19.1); greatest length of nasals, 12.9 (12.5–13.4); greatest width of rostrum near end, 3.0 (2.8–3.2); width of maxillary arch at middle, 4.8 (4.6–5.1).

Weights for this subspecies are not available, but the average, by estimate based on body length, is doubtless slightly under that for *merriami*, about 38 grams.

*Type locality.*—Agua Caliente [= Palm Springs, Riverside County], California. Type, female young-adult, skin and skull in good condition, collected by R. B. Herron, October 19, 1893; no. 1616,

Acad. Nat. Sci. Phila. (Rhoads, 1894a, p. 410; also examined by writer May 18, 1921).

*Distribution area.*—In general terms, the Colorado Desert. Ranges northwest as far as Cabezon, in San Geronio Pass; west as far as La Puerta and Vallecito, in eastern San Diego County; north, along the Colorado River nearly to the vicinity of Palo Verde; east to the Colorado River, and beyond in the vicinity of Yuma; south across the Mexican line. Altitudinal range, —180 to 3500 feet. Life-zone, Lower Sonoran. (See map, fig. U.)

The following localities in California are represented in the material examined, the number of specimens from each place being also indicated. Riverside County: near Cabezon, 7; Cabezon, 2 (1 in coll. D. R. Dickey, 1 in coll. A. B. Howell); Whitewater, 12; Snow Creek at 1500 feet, near Whitewater, 10; Palm Springs, 26 (2 in D. R. Dickey coll., 7 in coll. A. B. Howell); Carrizo Creek, 3000 feet, Santa Rosa Mts., 3; Dos Palms Spring, 3500 feet, Santa Rosa Mts., 7; Coachella, 2 (in D. R. Dickey coll.); Thermal, 3 (in coll. A. B. Howell); Mecca, 70. Imperial County: Colorado River, opposite Cibola, 16; Colorado River, twenty miles north of Picacho, 17; Colorado River, eight miles east of Picacho, 12; Potholes, 5; Bard, 5 (in coll. A. B. Howell); Colorado River near Pilot Knob, 19; Silsbee, 10; Coyote Well, 17; Salt Creek, near Salton Sea, 4; Carrizo Creek, 10 (5 in D. R. Dickey coll.); southwest side Salton Sea, 3; Salton Sea near New River, 4. San Diego County (extreme eastern): Mountain Spring, 2; San Felipe Valley, 3; La Puerta, 9 (4 in D. R. Dickey coll.); Vallecito, 6. Total number of specimens examined, 284.

### **Dipodomys merriami parvus** Rhoads

#### San Bernardino Kangaroo Rat

(Pl. 6, fig. 40; text-figs. S, U)

*Dipodomys parvus* Rhoads (1894b, p. 70) [orig. descr.]; and of some authors.

*Dipodomys merriami parvus*, Merriam (1898, p. 31); and of most authors.

*Diagnosis.*—Closely similar to *D. merriami merriami*, but size averaging smaller (about 10 per cent by weight), pelage less silky, and coloration relatively gray-toned, usually avellaneous over-washed with dusky rather than strongly ochraceous; black markings of face and tail rather more emphasized; bullae relatively less inflated.

*Comparisons.*—Parvus differs sharply and constantly in color from its neighbor *simiolus*, being very much darker and more grayish in tone. Yet these two races are situated only 15 miles apart at the nearest approach of their ranges (Vallevista and Cabezon, respectively). The color differences are less between *parvus* and *merriami*, since the latter averages darker than *simiolus*; but here dimensions are serviceable, as *parvus* averages decidedly smaller than *merriami*, particularly as regards bullae. With *nitratoides* and *exilis* the external similarities are closer and separation consequently more difficult. But certain cranial features are then diagnostic. These cases are discussed under their appropriate headings.



*Measurements.*—Ten adult and subadult specimens, 5 males and 5 females, from the Pacific slopes of San Bernardino and Riverside counties, show average and extreme measurements, in millimeters, as follows: total length, 232 (220–243); tail vertebrae, 136 (123–147); hind foot, 36 (35–37); ear from crown, 10 [in each of but two specimens measured fresh]; greatest length of skull, 34.5 (33.6–35.6); breadth of skull across bullae, 22.0 (21.6–22.7); spread of maxillary arches, 19.3 (18.2–20.0); greatest length of nasals, 12.9 (12.2–13.3); greatest width of rostrum near end, 3.0 (2.7–3.2); width of maxillary arch at middle, 5.1 (4.8–5.5).

Weights, in grams, of two of the above specimens, taken near Colton, October 29, were as follows: male, 36.3; female, 35.6; average, 36.0.

*Type locality.*—San Bernardino [really Reche Cañon, four miles southeast of Colton, according to R. B. Herron, interviewed by writer October 28, 1916], San Bernardino County, California. Type, skin and skull of adult female in good condition, collected by R. B. Herron, June 12, 1892; orig. no. 1213, coll. S. N. Rhoads (Rhoads, 1894b, p. 70); now no. 8213, Acad. Nat. Sci. Phila. (examined by writer May 18, 1921).

*Distribution area.*—The San Bernardino and San Jacinto valleys, on the Pacific slope of southern California in San Bernardino and Riverside counties. Northernmost station, Cajon Wash; southernmost, Vallevista. Altitudinal range, 1000 to 1800 feet. Life-zone, Lower Sonoran. (See map, fig. U.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. San Bernardino County: Cajon Wash, near San Bernardino, 12; Reche Cañon, four miles southeast of Colton, 11. Riverside County: Jurupa Mountains, seven miles northwest of Riverside, 8; Vallevista, San Jacinto Valley, 10. Total number of specimens examined, 41.

## ***Dipodomys nitratoideus nitratoideus* Merriam**

### **Tipton Kangaroo Rat**

(PL 2, fig. 8; pl. 6, fig. 41; text-figs. 8, U, V)

*Dipodomys merriami nitratoideus* Merriam (1894, pp. 112–113) [orig. descr.]; and, in part at least, of authors generally.

*Diagnosis.*—Similar to *D. merriami merriami*, but general size somewhat less, pelage coarser, less silky, and dorsal coloration slightly less brightly ochraceous; dark markings at whisker bases blacker, and coalescing across bridge of nose to form a conspicuous double crescent or arietiform facial marking; dark tail stripes broader and as a rule blacker. Rostrum of skull decidedly shorter than in *merriami* and other races in the same group outside of the San Joaquin Valley, and angles on each side better defined, less obtuse; premaxillary tongues narrower and, as a result, base of rostrum decidedly narrower.

*Comparisons.*—At first glance *nitratoideus* appears to differ scarcely at all from *D. m. merriami*; but closer scrutiny shows that there are excellent distinguishing characters. One practically unfailing feature

is external and hence easily ascertained when looked for: the dark dorsal and ventral tail stripes in *nitratooides* are broader than the white lateral tail stripes; conversely, in *merriami* the white lateral tail stripes are always broader than even the dark dorsal one, and the dark ventral one is narrower yet or almost wanting. While cranially close to *merriami* in most respects, there is a positive difference in the narrowness of the rostrum; in *nitratooides* the sides of the rostrum are more nearly parallel to one another, and the angle made by each side with the anterior margin of the adjacent maxillary arch is better defined, less obtuse (see fig. V). The nasals, and the rostrum itself, are distinctly shorter. These cranial differences are, in so far as material has been looked over, perfectly constant; hence the full specific status of *nitratooides*, as introduced into nomenclature here.

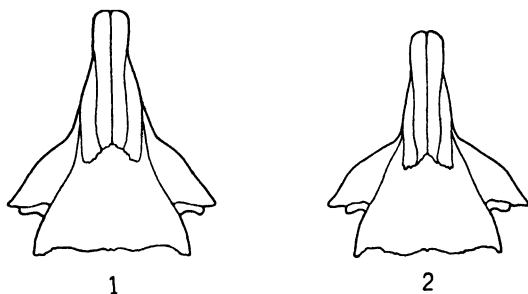


Fig. V. 1, Dorsal view of forward part of the skull of *Dipodomys merriami*, no. 27125, ♂;  $\times 1\frac{1}{2}$ . 2, Dorsal view of forward part of skull of *Dipodomys nitratooides nitratooides*, no. 14277, ♂;  $\times 1\frac{1}{2}$ . In the latter as compared with the former, note relatively short and narrow rostrum and narrow premaxillary tongues; also better defined, less obtuse angle on each side, as formed by side of rostrum and forward margin of maxillary arch.

In external appearance *nitratooides* averages darker, less ashy, in color tone, than *parvus*, with heavier facial marking; but these two forms are so exceedingly similar that some skins cannot be distinguished with certainty. The cranial feature, of short, narrow-based rostrum, in *nitratooides*, however, then serves unequivocally to separate it from *parvus*. This difference holds even in two-thirds grown young.

*Variations*.—In the original description of *nitratooides* (Merriam, 1894, p. 112) stress is laid upon the “fulvous” tone of coloration of the type series, and comparison is made with “*nitratus*.” As shown elsewhere (p. 76) the peculiar color of “*nitratus*” (= *merriami* from areas of alkaline soil) is purely adventitious; so also is the “fulvous” color originally ascribed to *nitratooides*. A series of 43 topotypes of the latter form are at hand, taken April 25 to 29, 1911, these all showing more or less discoloration. A selected example (no. 14301) shows a dorsal tone approximating sayal brown; the dark areas on tail, and the soles of hind feet, are close to snuff brown. As compared with similarly “alkalied” *merriami*, these *nitratooides* are very much darker in tone of dark parts; and, of course, the blackish facial marking and greater width of dark tail stripes also obtain, serving as features of diagnostic value.

*Nitratoides* from localities with well-drained soil show little change in color tone from fall to spring, that is, from fresh to relatively worn condition. The quality of the pelage changes somewhat, becoming more hispid, using this term qualifiedly as pertaining to a kangaroo rat. Even in its freshest condition the pelage of *nitratoides* is not nearly so soft and silky to the touch as in *merriami*. The young show these differences in about the same degree as do adults.

*Measurements*.—Ten adult specimens, 5 males and 5 females, from Tipton, Tulare County, show average and extreme measurements, in millimeters, as follows: total length, 233 (220–253); tail vertebrae, 139 (120–152); hind foot, 35 (33–37); ear [see below]; greatest length of skull, 33.6 (32.4–34.7); breadth of skull across bullae, 21.9 (21.4–22.4); spread of maxillary arches, 18.7 (18.2–19.1); greatest length of nasals, 12.0 (11.3–12.5); greatest width of rostrum near end, 3.0 (2.8–3.2); width of maxillary arch at middle, 4.7 (4.1–5.0).

Ear from crown, measured fresh, in 5 males and 5 females, from Earlimart, Tulare County: 9.8 (9–11).

Weights, in grams, of 5 males and 5 females, adults and subadults, from Earlimart, taken May 16 to 20, were as follows: average, 36.6 (28.0–43.2).

*Type locality*.—Tipton [Tulare County], San Joaquin Valley, California (Merriam, 1894, p. 112). Type collected by Clark P. Streater, June 25, 1893; now no. 54674, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 58).

*Distribution area*.—The floor of the southeastern (upper) side and end of the San Joaquin Valley, from Tipton, Tulare County, south to Caliente Wash, Kern County, and west to north side of Buena Vista Lake. Altitudinal range, 250 to 600 feet. Life-zone, Lower Sonoran. (See map, fig. U.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Tulare County: Tipton, 43; Earlimart, 29. Kern County: eight miles north-east of Bakersfield, 15; Bakersfield, 1 (in coll. D. R. Dickey); Caliente Creek wash at 600 feet, 17; twelve miles south-southwest of Bakersfield, 1; three miles north of Buena Vista Lake, 5 (in coll. D. R. Dickey). Total number of specimens examined, 111.

### ***Dipodomys nitratoides exilis* Merriam**

#### **Fresno Kangaroo Rat**

(Pl. 6, fig. 43; text-figs. S, U)

*Dipodomys merriami exilis* Merriam (1894, p. 113) [orig. descr.]; and of authors generally.

*Diagnosis*.—Most similar to *nitratoides* in general characters, but size decidedly smaller (hind foot only 33 or 34 mm. long). Tone of coloration darker than in *nitratoides*; dorsum close to snuff brown, obscured by dusky hair tippings medially; light areas on sides of head more reduced and overwashed with dusky; dark facial markings heavier.

*Remarks.*—*Exilis* is the smallest *Dipodomys* known, as well as the smallest member of the *merriami* group. A glance at the ear, hind foot, or skull is usually sufficient to make identity of any specimen certain. *Exilis* is also the darkest colored member of its group; the general tone approaches snuff brown in fresh pelage, and the facial markings are notably heavy. Because of the general small size of the animal, the skull looks particularly light. The bullae are much smaller than in *nitratoides* even, and the rostrum is much shorter, though the relative proportions are probably about the same.

*Measurements.*—Four adult and subadult specimens, three males and one female, from Fresno, show average and extreme measurements, in millimeters, as follows: total length, 216 (211–226); tail vertebrae, 128 (126–128); hind foot, 33 (33–34); ear from crown, 8.5 (8–9) [estimate, based on dry specimens]; greatest length of skull, 31.3 (30.7–32.7); breadth of skull across bullae, 20.2 (20.0–20.6); spread of maxillary arches, 17.4 (16.3–18.4); greatest length of nasals, 10.8 (10.2–11.4); greatest width of rostrum near end, 2.8 (2.7–3.0); width of maxillary arch at middle, 4.3 (4.1–4.5).

Merriam (1894, p. 113) gives the average measurements of 20 specimens from the type locality as: total length, 227; tail vertebrae, 135.5; hind foot, 34.

Weights are not available for this race; but figuring from body length, on the basis of known weights in other species and subspecies, *exilis* weighs on an average about 34 grams.

*Type locality.*—Fresno, San Joaquin Valley, California (Merriam, 1894, p. 113). Type collected by Vernon Bailey, September 23, 1891; now no. <sup>34843</sup><sub>43823</sub>, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 57).

*Distribution area.*—So far as now known, only a small portion of the east side of the San Joaquin Valley north of Tulare Lake, in the immediate vicinity of Fresno. Altitude of Fresno district, about 300 feet. Life-zone, Lower Sonoran. (See map, fig. U.)

Only 4 specimens of this subspecies have been examined by the writer, these taken by Clark P. Streater at Fresno in April, 1898. Much recent effort to get fresh examples has failed, and it is now thought likely that the race is extinct as a result of the close cultivation of the territory it formerly occupied.

### ***Dipodomys nitratoides brevinasus* Grinnell**

Short-nosed Kangaroo Rat

(PL 6, fig. 42; text-figs. S, U)

*Dipodomys merriami brevinasus* Grinnell (1920, p. 179) [orig. descr.].

*Diagnosis.*—Like *nitratoides* in characters of skull, except for greater inflation of mastoid bullae and hence greater mastoid width. In color, slightly paler, more ochraceous, than in *nitratoides* and much paler than in *exilis*, averaging close to *merriami*; but differs from *merriami* in more extended dark facial and tail markings. Size much larger than in *exilis*.

*Remarks.*—*Brevinasus* probably owes the relative paleness of its color tone to the aridity of its habitat. This lies in the rain-shadow of the coast ranges of mountains which form the western rim of the San Joaquin Valley. *Nitratoides* and *exilis*, of the eastern side of the San Joaquin Valley, are both darker in tone. Certain examples of *brevinasus* from McKittrick are palest of all, and these differ externally from average *merriami* only in dusker ear, better defined facial marking, and wider dark tail stripes.

The greater mastoid inflation in *brevinasus* as compared with *nitratoides* and *exilis* brings a narrowing of the interparietal and supra-occipital; also the greater projection backwards of the mastoid bullae means a deepening of the "occipital notch" between them, as shown when viewed dorsally. These are good characters for the separation of series, though individual variation leads to difficulty in allocating occasional specimens. The shortness and basal narrowness of the rostrum is at least as extreme in *brevinasus* as in *nitratoides*, so that skulls are readily distinguishable from those of *merriami* and subspecies.

*Measurements.*—Ten adult specimens, 5 males and 5 females, from western Fresno County (near Mendota and nineteen miles southwest of Mendota), show average and extreme measurements, in millimeters, as follows: total length, 237 (221–252); tail vertebrae, 135 (125–145); hind foot, 35.4 (35–37); ear from crown, 10.8 (10–12); greatest length of skull, 34.4 (33.8–35.0); breadth of skull across bullae, 22.5 (22.0–23.2); spread of maxillary arches, 19.2 (18.9–19.7); greatest length of nasals, 12.1 (11.8–12.6); greatest width of rostrum near end, 3.0 (2.8–3.0); width of maxillary arch at middle, 4.7 (4.5–5.0).

Weights, in grams, of the above ten specimens, which were taken from June 16 to 30, were as follows: average, 43.9 (39.6–52.6).

*Type locality.*—Hayes Station, near B. M. 503, 19 miles southwest of Mendota, Fresno County, California (Grinnell, 1920, p. 179). Type collected by Richard Hunt, June 30, 1918; now no. 28634, Mus. Vert. Zool.

*Distribution area.*—The floor of the west side of the San Joaquin Valley, from near the mouth of Panoche Creek, in western Fresno County, south to near mouth of San Emigdio Creek, in southwestern Kern County. Altitudinal range, 175 to 600 feet. Life-zone, Lower Sonoran. (See map, fig. U.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Fresno County (western side): Mendota, 15; nineteen miles southwest of Mendota (near mouth of Panoche Creek), 16. Kern County: McKittrick, 25; near Wheeler Ridge at 600 feet, 2; near mouth of San Emigdio Creek at 450 to 600 feet, 7. Total number of specimens examined, 65.

**Dipodomys agilis agilis** Gambel

## Gambel Kangaroo Rat

(Pl. 5, fig. 30; pl. 6, fig. 44; text-figs. I, Q, R, S, W)

*Dipodomys agilis* Gambel (1848, pp. 77-78) [orig. descr.]; and, in part at least, of various authors.

*D[ipodomys]. Wagneri* LeConte (1853, p. 224) [orig. descr.].

*Dipodomys phillipii* [or *phillipsii*], Baird (1857, p. 413), part; and, in part, of some other authors.

*D[ipodops]. agilis*, Merriam (1890a, p. 72); and of some authors.

*Perodipus agilis*, Fitzinger (1867, p. 126); and, in part at least, of various authors.

*Cricetodipus agilis*, Trouessart (1897, p. 580), part.

*Perodipus agilis agilis*, Miller (1912, p. 273); and of authors.

**Diagnosis.**—A middle-sized, normally five-toed, rather narrow-faced kangaroo rat, of moderately dark type of coloration; dorsal color tone dusky cinnamon-buff; facial double-crescent strongly developed, blackish; dorsal and ventral blackish tail stripes, both of them, broader than intervening white stripes; tail dusky-ended; ear rather large (more than 13 mm. from crown), and blackish predominating in hairing. Skull with rather narrowly spreading and weakly angled maxillary arches; bullae of moderate inflation, and supra-occipital and interparietal rather broad.

**Preliminary note.**—*Dipodomys agilis agilis* is selected for rather fuller treatment than most others of the kangaroo rats of California so that it can be used as more or less of a standard with which to compare all the rest. This is done for the following reasons: As now restricted, it is the longest known and perhaps the best known of our species; because it inhabits a well-settled and readily accessible part of California, specimens are easily obtainable; in fact, good series are already contained in practically all the public and private collections of mammals in America; it is normally a five-toed species; in size it is just about midway between the extremes found in the genus; in proportions of tail and hind foot it is practically an average; although in size of ear it is above the average, and in depth of color it is darker than most species, it does not reach the extremes in these respects. In other words, *agilis* is a fairly typical kangaroo rat, taking all features into consideration.

**Pelage.**—Long and silky, dense except on chin; longest on rump where the hairs reach a length of 19 millimeters; on top of head the hairs are 9 mm. long, on belly 10, on chin 2.5. Whiskers abundant, grading as to length in a series down side of nose to upper lip where shortest at median line; longest whiskers 67 mm. long and reaching back along sides of body fully halfway to base of tail; supra-ocular and postocular vibrissae few and reaching a length of 20 and 19 mm., respectively. Ear lightly clothed with short hairs, 1 mm. or less in length, except at forward base where some longer ones partially conceal the rims of the pinna. Fore foot and toes clothed with hairs

except on ventral surfaces of latter and on the opposable palmar tuberosity. Hind foot fully clothed with hairs 1 to 1.5 mm. long on upper surface and hinder part of sole; pelage somewhat longer on fore part of sole, and this pelage together with that on under side of toes tending to form a dense hairy pad. Pelage on basal two-thirds of tail short (1 to 1.5 mm.) and often so sparse as to allow the transverse scalation to show through; longest hairs of terminal tuft about 23 mm. long; a dorsal crest of elongated hairs is discernible forward from the tuft for about one-third the length of the tail vertebrae.

*Coloration.*—Pelage of whole lower surface of body from under side of tip of nose to base of tail, including lining of cheek-pouches, pure white; fore legs and feet entirely white; hind foot white, save for an abrupt blackish stripe on sole from heel to bases of toes; inside of each thigh white, this white being continuous with that of belly and of upper side of hind foot; outer side of each thigh with a dark patch colored like back; this patch separated from adjacent dorsal area by a sharp band of white, the latter thus being continuous at either end with white of inside of thigh. Upper surface of body from tip of nose to base of tail and white thigh bands, continuously dusky cinnamon-buff, this color clearest along sides and most obscured by black subterminal intervals on the hairs on top of head and down middle of back from between shoulders to base of tail; patches on outer sides of thighs like back, becoming blackish on outsides of ankles; color of dark upper surface sharply demarked along sides against white of lower surface; pelage on back extensively slate-gray at base, that on lower portions of sides between fore and hind legs, white at base; a blackish patch on each side of face at base of whiskers; a crescentic dusky bar from each of these two patches extends forward to join its fellow on top of nose; eyelids blackish; area between eye and black whisker patch, dull buffy white; light spot above eye, dull buffy white; hairs at hinder base of ear (for the most part concealed by the ear unless latter is lifted), silky white; a white spot at forward base of ear; ear dull blackish brown save for a whitish spot at tip of upper fold-over and a few white hairs on inner surface of pinna towards base; longer whiskers blackish, shorter ones in series towards mouth whitish; tail sharply four-striped, the two white lateral stripes narrower than the blackish dorsal and ventral stripes; the black stripes are cut off from body color at base of tail by a complete ring of white; all the stripes tend to become less well defined toward end of tail; hairs of terminal crest and tuft of tail dull brownish black (close to clove brown), becoming dull white at bases.

*Variation in color.*—After attaining adult estate, there is but one molt annually, in late summer and fall. Specimens at hand showing molt in progress range in date from July 11 to September 20. The molt begins on the head and progresses posteriorly. I am unable to see that any marked fading or change of color due to wear takes place from October to June, save that the dusky crest and terminal tuft of the tail in some early summer specimens is noticeably pale, drab rather than blackish. It may be remarked here that over-stuffing of study skins, and consequent spreading of the pelage, changes the general tone of color on the dorsum; the black subapical bands of the hairs and the slate-color of their basal two-thirds then tend more to

show through the cinnamon-buff of the massed tipplings. Fading may account in part for the whiter tone shown by the light cheek-patch and spot over eye, in some specimens.

Juveniles, which are trapped abroad when they are yet only four-month grown, are like adults in pattern of coloration, but are grayer in tone on back; the mid-dorsal area from nose to base of tail is fuscous, seemingly due to dusky tipplings to the hairs, which latter are only subterminally cinnamon-buff. Specimens at hand in juvenile pelage bear dates from May 24 to October 4. There is probably but one litter a year.

There is some slight geographical variation locally within the range of the subspecies *agilis*. Thus, a series from Cajon Wash, near San Bernardino, is paler in general tone of coloration than the series from the near vicinity of Los Angeles. A series from Banning, Riverside County, contains specimens which are almost as pale-colored as typical examples of the subspecies *cabezona* from farther over San Gorgonio Pass toward the desert; but the mean color tone of the Banning specimens seems to place them nearest to *agilis*, and they are listed under this name. A series from Kenworthy, on the southern side of the San Jacinto Mountains, shows much variation in color, some examples approaching *cabezona* in relative paleness, some being nearer *simulans*. This series as a whole is here listed under *agilis*, although it affords satisfactory evidence of intergradation between all three of these forms in that vicinity.

*Skull*.—For definite knowledge of the chief features of the skull of *agilis*, the student is referred to the accompanying illustrations. The outstanding characters of the skull of *agilis* as compared with that of many other species of kangaroo rats are as follows: relative narrowness of cranium, narrow spread of maxillary arches, lesser width and weaker posterior angulation of maxillary arch, lesser inflation of bullae, and broadness of interparietal and supra-occipital. Some of these characters are given accurate expression in the measurements.

A series of skulls from any one locality shows individual variations which with scanty material might be misleading. There is more and less inflation of the bullae, and more and less narrow spread of maxillary arches. The range of variation in some respects is indicated in the measurements given later. It is the *mass effect* that will serve best in diagnosis between closely related forms, not individual specimens.

Age obviously accounts for some of the variation in a series. Young adults as compared with old adults have, as a rule, relatively smaller bullae, an appearance of elevation in the fronto-parietal region (in other words, the brain case bulges dorsally), and the lateral outlines of the frontal are straighter and more convergent anteriorly. It is significant, however, to observe that when skulls of different species of similar age are compared, the specific differences are found to be nearly or quite as conspicuous in the young even half-grown as in the adult.

When series of skulls from different localities are compared, slight average differences are sometimes apparent. For instance, a series of *agilis* from Reche Cañon, near Colton, shows greater inflation of



the bullae than a series from the vicinity of Los Angeles. This may be considered a geographic tendency toward the condition in the subspecies *simulans*, of San Diego County, where greater size of bullae is one of the characteristic features.

The two sexes in all the kangaroo rats, if of the same age, appear to be practically identical as regards both size and proportions of the skull.

*Toes*.—As regards the toes, four individuals out of the 239 specimens of *agilis* examined show departure from the normal condition in which the claw on the first digit although small is easy to see on both hind feet. Three of these specimens were trapped in San Fernando Valley, Los Angeles County, by H. S. Swarth. No. 9494 is an immature female, taken October 30, 1903, and shows no trace of a first claw on either hind foot; a slight swelling under the shrunken skin of the left foot might indicate the presence there of the rudiment of a digit. No. 9496 is an adult female, also taken October 30, 1903, and presents a normal first claw and digit on the left hind foot, but the right hind foot shows no trace of claw and no sure external evidence even of any phalanges representing a first digit. No. 9497, an adult male taken November 1, 1903, is in exactly the same condition as no. 9496.

These three specimens, in which either one or both first hind claws are missing, were, curiously, all taken in the same trap-line. In all perceived characters they are otherwise quite identical with the rest of the series of *agilis* obtained in the same vicinity.

In a specimen of *agilis* from another locality (no. 2612, male adult, from Reche Cañon near Colton), the first claw is missing on the right hind foot, though present in average condition on the left hind foot.

*Measurements*.—Ten selected adult specimens, 5 males and 5 females, from the lower San Fernando Valley and vicinity of Pasadena, in Los Angeles County, show averages and extremes, in millimeters, as follows: total length, 293 (270–815); tail vertebrae, 179 (162–197); hind foot, 43 (41–46); greatest length of skull, 39.5 (37.5–40.5); breadth of skull across bullae, 24.1 (23.3–24.8); spread of maxillary arches, 21.1 (20.0–22.0); greatest length of nasals, 14.3 (13.2–15.0); greatest width of rostrum near end, 4.1 (3.4–4.4); width of maxillary arch at middle, 4.9 (4.7–5.3).

Ten specimens, 5 males and 5 females, from Reche Cañon, near Colton, in San Bernardino County, give: ear from crown, 13.4 (13–14); weight, in grams, 56.1 (45.2–74.8).

*The disposal of the name wagneri*.—The original description of "*Dipodomys* [sic] *Wagneri*" (Le Conte, 1853, p. 224) pertains wholly to external features and contains nothing really diagnostic of any one species of kangaroo rat. But the type is still extant (no. 148, in the mammal collection of the Philadelphia Academy), and certain points in the description show that this is the type, with no doubt whatsoever. Through the kindness of Dr. Stone, the writer has had the type in his possession for study and has also been privileged to remove the skull. It is probable that the specimen, within recent years unmounted by Dr. Stone, was originally preserved in alcohol, for the skin was found to be unseparated from the forward part of the skull. Moreover, the white portions of the pelage are changed to dull yellowish and the

blackish and dusky parts to brown, as a likely result of both soaking in some fluid and long exposure to light.

The specimen is of an adult animal, and, as remarked by LeConte, most of the tail is wanting. The skull proves to be in remarkably good condition, considering its history, only the extreme basal portion having been destroyed for the removal of the brains. The great relative width of both of the dark tail stripes shows that the specimen cannot belong to any of our desert species of *Dipodomys*. This feature, plus the large ear (about 13.5 mm.), plus the extent of dark sole stripe and dusky on the ankles, plus the presence of a distinct first claw on each hind foot, places it in the *agilis* series. And the narrow-faced style of skull with weak-angled maxillary arches and moderately inflated mastoid bullae brings it down to *D. a. agilis*. Indeed the skull is a practical duplicate, in size as well as proportions, of selected examples of *agilis* from Los Angeles County, whence the specimen was therefore likely obtained. The original label bears the inscription "James Reid S Carolina." As pointed out by Coues (1875, p. 326, footnote), this probably merely indicates the donor and his residence. At any rate that locality is impossible; and there is no better designation of the source of the specimen forthcoming from the literature or from the records at the Philadelphia Academy. The name *wagneri* is thus to be disposed of as a synonym of *agilis*, the latter being of earlier date. By the way, LeConte evidently named this supposed new species after Johann Andreas Wagner, 1797-1861, one-time professor of zoology at the University of Munich, and author of numerous papers on mammals which were appearing about the time of LeConte's own activity in systematic zoology. (See Palmer, 1904, p. 709.)

*Type locality*.—"The Pueblo de los Angeles, Upper California" (Gambel, 1848, p. 78); a specimen (no. 9490, Mus. Vert. Zool) from north end of Vermont Avenue near Griffith Park, suburbs of Los Angeles, may be considered a practical topotype. Collector of type, William Gambel; original type specimen "lost" (Gambel, 1848, p. 78, under "*Mus Californicus*").

*Distribution area*.—Southern California, almost altogether on its Pacific slope, from northern Santa Barbara County southeast through Ventura, Los Angeles and Orange counties into western San Bernardino and western Riverside counties as far as the San Bernardino and San Jacinto mountains. Altitudinal range, close to sea level up to 7500 feet. Life-zone, chiefly Upper Sonoran, but extends locally up into Transition and down into Lower Sonoran. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Santa Barbara County: Schoolhouse Cañon, 2500 feet, in Cuyama Valley, 1. Ventura County: Matilija, 19. Los Angeles County: Elizabeth Lake, 3400 feet, 1; San Francisquito Cañon, 2500 feet, 3; Boquet Cañon, 1 (in coll. A. B. Howell); vicinity of San Fernando, 14; near Lankershim (=Toluca), 30 (in coll. J. E. Law); Los Angeles (near north end Vermont Avenue), 1; vicinity of Pasadena, 18; Monrovia, 12 (in coll. Calif. Acad. Sci.); San Gabriel River bottom near El Monte, 12; San Gabriel River wash near Azusa, 4; Glendora, 2; Covina, 3 (in coll. A. B. Howell). San Bernardino County: San Bernardino Moun-

tains at 7500 feet, north base of Sugarloaf Mountain, 3; Grapeland, 7 (4 in coll. A. B. Howell); Cajon Wash at 1100 feet, near San Bernardino, 11; San Bernardino, 6 (in coll. D. R. Dickey); Reche Cañon, near Colton, 31. Riverside County: Jurupa Mountains at 1100 feet, seven miles northwest of Riverside, 4; Alessandro Valley, 1600 feet,

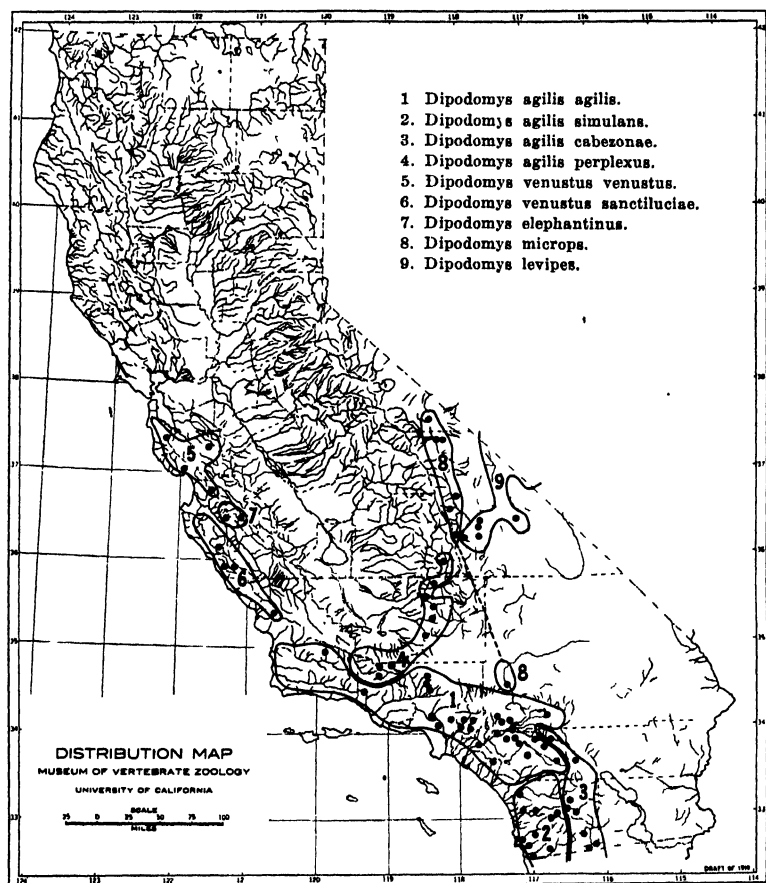


Fig. W. Map showing stations of occurrence in California of kangaroo rats of the *agilis* and *microps* groups, as established by specimens examined by the author. Assumed general range of each form within the state outlined.

seven miles southeast of Riverside, 5; two miles west of Moreno, 3; Winchester, 13 (in D. R. Dickey coll.); near Banning, 6; Schain's Ranch, 4900 feet, San Jacinto Mountains, 6; Kenworthy, 4500 feet, San Jacinto Mountains, 16. Orange County: Santa Ana Cañon, 400 feet, fifteen miles northwest of Santa Ana, 6; mouth of Trabuco Cañon at 1500 feet, 1. Total number of specimens examined, 239.

**Dipodomys agilis simulans** (Merriam)

## Dulzura Kangaroo Rat

(PL 5, fig. 31; text-figs. S, W)

*Dipodomys agilis*, LeConte (1853, p. 224), part; and, in part at least, of some other authors.

*Perodipus streator simulans* Merriam (1904, p. 144) [orig. descr.], part; and, in part at least, of certain other authors.

*Dipodomys californicus*, Elliot (1907, p. 325), part.

*Perodipus agilis*, Elliot (1907, p. 327), part; and, in part at least, of some other authors.

*Perodipus simulans simulans*, Miller (1912, p. 276).

*Perodipus agilis agilis*, Grinnell (1913, p. 335), part.

**Diagnosis.**—Closely similar to *D. agilis agilis*, differing in slightly smaller size, darker general coloration, and in somewhat larger bullae; color of dorsum dusky pinkish cinnamon rather than dusky cinnamon-buff; facial dark markings heavier and ear blacker; breadth of skull across bullae (as an index of bullar inflation) averaging 24.7 instead of 24.1.

**Comparisons.**—As far as I am able to discern, *simulans* differs from *agilis* only slightly and inconstantly, in smaller size, in greater inflation of bullae, and in darker coloration. The latter feature can be seen to consist in more cinnamon tone of body color, in reduction of white or pale markings, and in increase of black or dark markings. In comparing considerable series of the two forms, from well within their respective ranges, it is easy to distinguish them in mass; but it is equally easy to pick out individuals here and there which are equivocal in characters. Moreover, the series of specimens (listed under *agilis*) from the southwestern slopes of the San Jacinto Mountains averages nearly between *agilis* and *simulans*. Intergradation thus takes place through both individual and geographic variation, and the trinomial form of designation should be employed.

*Simulans* was originally compared (Merriam, 1904, p. 144) with *streator* (= *heermanni*) because of its size and its similar dark tone of coloration; but the narrow-faced skull of the former, altogether *agilis*-like, shows its relationship with "*streator*" to be remote.

**Variations.**—As intimated above, individual specimens even from within the metropolis of *simulans* are at hand which are seemingly identical with specimens from the metropolis of *agilis*; the differences are average. On the other hand, the darkest specimen of *simulans* (no. 5194, from Escondido, August 25, 1904) is conspicuously different from even the darkest available *agilis*; the dorsum is deeply cinnamon tinged, the ears are almost solidly black, and the whisker patches are joined together over the bridge of the nose into a continuously and solidly black arietiform figure almost as bold as in *morroensis*.

As regards bullae, examples of *simulans* showing an extreme of inflation in these cranial parts are easily distinguishable from any

typical *agilis*. Not only is the aggregate volume of the bullae in such specimens appreciably greater, but the bullae protrude farther backwards leaving a deeper occipital sulcus between them; the supra-occipital and interparietal are narrower also.

*Toes*.—*Simulans* is normally five-toed. Merriam (1904, p. 144) states that "some specimens (about 1 in 10) of this subspecies" . . . "lack the hallux or the hallux has no claw." One such specimen (no. 36297, U. S. Biol. Surv. coll.) is at hand, the first claw being absent on both hind feet. This is the only one which happens to be so characterized out of the 61 specimens of *simulans* examined by the writer.

*Measurements*.—Ten adult and subadult specimens, 6 males and 4 females, from the type locality of *simulans*, Dulzura, show average and extreme measurements, in millimeters, as follows: total length, 285 (265–295); tail vertebrae, 173 (155–185); hind foot, 42 (40–44); ear [see paragraph below]; greatest length of skull, 38.8 (38.2–39.9); breadth of skull across bullae, 24.7 (23.9–25.4); spread of maxillary arches, 20.3 (19.4–21.8); greatest length of nasals, 13.9 (13.6–14.3); greatest width of rostrum near end, 3.8 (3.3–4.1); width of maxillary arch at middle, 4.7 (4.1–5.0).

No ear measurements from fresh specimens, taken in accordance with the method here used, are available. But comparisons based upon dried specimens indicate that the ear of *simulans* averages a trifle smaller than in *agilis*, namely about 13.0. Neither are weights available for *simulans*; but figuring from relative length of body on the basis of known weights in other species and subspecies, this form weighs on an average about 61 grams.

*Type locality*.—Dulzura, San Diego County, California (Merriam, 1904, p. 144). Type collected by C. H. Marsh, November 24, 1891;

now no.  $\frac{33105}{45103}$ , Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 62).

*Distribution area*.—The Pacific slope of San Diego County, probably extending south into Lower California. Altitudinal range, from sea level up to 3000 feet. Life-zone, Upper Sonoran, ranging locally down into Lower Sonoran. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. San Diego County: Bonsall, 6 (in D. R. Dickey coll.); Escondido, 4 (1 in D. R. Dickey coll.); San Pasqual Valley, 2 (1 in coll. Stanford Univ., 1 in D. R. Dickey coll.); El Cajon, 1 (in D. R. Dickey coll.); Witch Creek, 2 (1 in coll. Stanford Univ.); Santa Ysabel, 1 (in coll. Stanford Univ.); San Diego, 4 (1 in coll. Stanford Univ., 2 in D. R. Dickey coll.); Chula Vista, 2; near mouth of Tiajuana River, 14; Dulzura, 25 (7 in U. S. Biol. Surv. coll., 7 in D. R. Dickey coll., 2 in coll. Stanford Univ., 6 in coll. A. B. Howell). Total number of specimens examined, 61.

**Dipodomys agilis cabezonae** (Merriam)

## Cabezón Kangaroo Rat

(Pl. 5, fig. 32; text-figs. I, S, W)

*Perodipus cabezonae* Merriam (1904, p. 144) [orig. descr.].*Perodipus agilis*, Elliot (1907, p. 327), part.*Perodipus agilis agilis*, Grinnell (1913, p. 335), part; and, in part, of some other authors.

**Diagnosis.**—Similar to *D. agilis agilis*, but differing in paler tone of coloration, reduction of dark markings, average smaller size, and, on an average, slightly larger bullae. Tone of color dorsally, light pinkish cinnamon, but faintly overcast with dusky; nose not black, only weakly dusky; whisker patches only dusky, not dead black; cheeks white, but faintly tinged with buffy; ears dull drab in general tone; ventral tail stripe narrower than in *agilis*, becoming obsolete posteriorly in many specimens, leaving the tail whiter towards the end; ankles and soles of hind feet, dusky instead of black.

**Comparisons.**—*Cabezonae* and *simulans* appear to me to be practically identical in size, proportions, and characters of skull. But in coloration the palest examples of *cabezonae* are strikingly different from the average of *simulans*. In San Diego County, these two forms are known to exist within 30 miles of each other; and the material at hand indicates intergradation through both individual and geographic variation, the latter farther to the northward, in the San Jacinto region. I am unable to distinguish most examples of *cabezonae* from the type locality, Cabezón, from specimens collected at Jacumba, in extreme eastern San Diego County. Some old individuals from Jacumba have bigger bullae than shown in the Cabezón lot. But the material at hand from the latter locality is mostly either quite young or only subadult; and when compared with selected specimens of *agilis*, as well as of *simulans* of similar age, I am unable to find any more than subspecific differences.

**Measurements.**—Ten selected adult and subadult specimens, 7 males and 3 females, from Cabezón, Riverside County, and Jacumba, San Diego County, show average and extreme measurements, in millimeters, as follows: total length, 283 (267–303); tail vertebrae, 171 (158–187); hind foot, 43 (40–45); greatest length of skull, 39.5 (38.3–41.3); breadth of skull across bullae, 24.5 (23.0–25.9); spread of maxillary arches, 20.8 (19.9–22.2); greatest length of nasals, 14.2 (13.2–14.9); greatest width of rostrum near end, 4.0 (3.6–4.2); width of maxillary arch at middle, 4.8 (4.3–5.3).

No ear measurements taken according to the method used in the present paper are available for *cabezonae*. But comparisons of dry specimens indicate that the ear of this race is practically identical in average (13.4) and extreme dimensions with *agilis* and *simulans*. Weights also are not available for *cabezonae*; but an estimate based on body length shows a probable average weight for *cabezonae* of 61 grams.

*Type locality*.—Cabezon, Colorado Desert [in San Geronio Pass, Riverside County], California (Merriam, 1904, p. 144). Type collected by C. P. Streater, May 31, 1893; now no. 54055, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 59).

*Distribution area*.—The desert slopes of the coastal mountains of southern California, from Cabezon, Riverside County, south through eastern San Diego County to, and probably beyond, the Mexican line. Altitudinal range, 1700–3500 feet. Life-zone, Upper Sonoran and upper edge of Lower Sonoran. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Riverside County: Cabezon, 1700 feet, 10 (5 in coll. U. S. Biol. Surv., 4 in coll. A. B. Howell); near Dos Palms Spring, on Carrizo Creek, 3000–3500 feet, Santa Rosa Mountains, 2. San Diego County: Warner Ranch and Warner Pass, 3000 feet, 6 (1 in coll. U. S. Biol. Surv.); Grapevine Spring, 1; San Felipe Valley, 2500 feet, 2 (1 in coll. U. S. Biol. Surv.); Banner, 2700 feet, 1; La Puerta Valley, 1; Jacumba, 11; Mountain Spring, 2. Total number of specimens examined, 36.

### *Dipodomys agilis perplexus* (Merriam)

#### Walker Basin Kangaroo Rat

(PL 5, fig. 29; text-figs. I, S, W)

*Dipodomys phillipsi*, Coves (1877, pp. 538, 540), part (?).

*D[ipodomys]. agilis*, True (1886, p. 413), part.

*Perodipus agilis*, Elliot (1904, p. 304), part; and, in part, of some other authors.

*Perodipus streatori*, Elliot (1907, p. 329), part (?).

*Perodipus perplexus* Merriam (1907, p. 79) [orig. descr.].

*Diagnosis*.—Similar to *D. agilis agilis*, but differing in larger size, notably larger ear, and slightly paler coloration; skull of same general proportions but larger, more heavily built, this especially with regard to incisors, breadth across frontal region of brain-case, and size of both tympanic and mastoid bullae. The latter protrude farther posteriorly. Breadth of skull across bullae 25.1, instead of 24.1 (in *agilis*); ear from crown, close to 15.4 instead of 13.4.

*Comparisons*.—The large ear is the best external feature for distinguishment of *perplexus* from most other kangaroo rats. Indeed, it is only exceeded or even equalled by *elephantinus*, *sanctiluciae*, and *venustus*. The slightly paler coloration of *perplexus* as compared with *agilis* resolves itself into a trifle less of dusky obscuration, especially along the sides, and a paling of the facial areas; the whisker and nose patches are not so deeply or extensively black, and the cheek (area between eye and whisker patch) is paler—almost pure white in some specimens. This general paleness of color is not, however, carried to the degree shown in the extreme of *cabezanae*; it becomes of real service in comparison with *simulans*, and with the forms to the northward, *elephantinus*, *sanctiluciae*, and *venustus*.

*Variations*.—Specimens from the head of Piru Creek, in Ventura County, although this point is less than twenty miles from Matilija, in the same county, where quite typical *agilis* is represented, are unequivocally *perplexus*. Yet these two forms are so similar in their main features that intergradation through individual variation becomes easily apparent in other material examined. Intergradation, however, with *sanctiluciae*, which might be expected to occur toward the northwest, is not shown by any material available. In both coloration and cranial features there is a decided gap between *perplexus* and *sanctiluciae*.

*Measurements*.—Ten adult specimens, 5 males and 5 females, from Walker Basin and vicinity, in Kern County, and Mount Pinos and vicinity, in Ventura County, give average and extreme measurements, in millimeters, as follows: total length, 303 (284–319); tail vertebrae, 184 (174–197); hind foot, 44.2 (43–46); greatest length of skull, 41.0 (40.0–41.7); breadth of skull across bullae, 25.1 (24.6–25.5); spread of maxillary arches, 22.4 (21.6–23.4); greatest length of nasals, 15.3 (15.0–15.8); greatest width of rostrum near end, 4.3 (4.0–4.5); width of maxillary arch at middle, 4.9 (4.6–5.2).

No properly taken ear measurements are available for this species. But comparisons and figures based upon dry specimens show the probable average measurement of "ear from crown" to be 15.4. Weights are available for two adult females taken near Tehachapi June 2 and 3 (1920); they are, in grams, 70.2 and 76.7; average, 73.5.

*Type locality*.—Walker Basin, Kern County, California (Merriam, 1907, p. 79). Type collected by Vernon Bailey, July 15, 1891;

now no.  $\frac{29261}{41328}$ , Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 61).

*Distribution area*.—The mountain ranges and included valleys lying around the southern end of the San Joaquin Valley. Recorded from Trout Creek, toward head of South Fork of Kern River, in Tulare County, southwest through the Tehachapi and Tejon country to head of Piru Creek, in Ventura County. Altitudinal range, 2400 to 6500 feet. Life-zone, Upper Sonoran. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Tulare County: Trout Creek, 6000 feet, Sierra Nevada, 6. Kern County: Fay Creek, 4100 feet, 2; Kern River at Bodfish, 2400 feet, 5; Rip Rap Mine, Piute Mountains, 2; Walker Basin, 3300 feet, 7; one and one-half miles north of Tehachapi, 2. Ventura County: Cuddy Cañon, 4400 feet, 1; south side Mount Pinos, 5500–6500 feet, 10; head of Piru Creek, 5000 feet, 3. Total number of specimens examined, 38.



**Dipodomys venustus venustus (Merriam)****Santa Cruz Kangaroo Rat**

(Pl. 5, fig. 33; text-figs. S, W)

*Dipodomys phillipsii*, Gray (1868, p. 200): "Var. Larger, darker, the colour more distinctly marked." "Found in dense thickets, Maccartysville [= Saratoga], Santa Clara county. It lives in the nests made by the *Neotoma*. Caught in traps during the night, baited with wheat' (Bridges)."

*Perodipus venustus* Merriam (1904, p. 142) [orig. descr.]; and of most authors.

*Dipodomys californicus*, Stone (1904, p. 587): Belmont, San Mateo County. [Specimen reexamined by Dr. Stone, according to letter of July 27, 1912, to present writer, and diagnosed as *venustus*.]

*Dipodomys venustus*, Grinnell (1919b, p. 204).

**Diagnosis.**—A rather large sized, five-toed, rather narrow-faced kangaroo rat, of dark coloration; general tone of dorsum close to cinnamon-brown, paling to ochraceous-tawny on lower sides; ear large (averaging 15.5 mm. from crown) and blackish in color save for gray tip of fold-over. Similar to *agilis* but darker, more deeply cinnamon with heavier dorsal over-wash of blackish, and facial dark markings bolder; ear much larger and tail longer; skull of narrow type as in *agilis*, but general size larger and rostrum proportionally longer (nasals averaging 15.6 mm. long instead of 14.3).

**Comparisons.**—*Venustus* is clearly related rather closely to *agilis*. Yet there is no bridging of the gap between these two forms, so far as present material shows, either through any intermediate race or by overlapping of characters in individuals. *Venustus* is much darker colored than *agilis*, and it is larger in all dimensions. In depth of color it is close to the darkest of all the kangaroo rats; only *morroensis* exceeds it. The two crescentic black whisker patches are broad and the whole top of the nose is black where these meet; the hairing of the ear is black, save for a few white hairs on the inner surface of the pinna basally and for a very restricted gray patch at tip of fold-over.

From *morroensis* and *goldmani*, *venustus* may be distinguished instantly by its very much larger ear, as well as by size differences. As compared with *californicus*, which is nearly as dark colored, *venustus* shows larger ear, and dark tipped instead of white tipped tail. Then, of course, each of the three forms just named are of the broad-faced rather than narrow-faced type and so show altogether different cranial characters. *Simulans* is almost as dark as *venustus*, but is much smaller, especially as to ear. *Perplexus* approaches *venustus* more closely in size, but it is very much paler, with dark markings relatively weakly developed. *Sanctiluciae*, though dark in color, does not show so deep a tinge of cinnamon-brown as *venustus*.

As to skull, *venustus* has the bullae much smaller than in *elephantinus*, and somewhat smaller than in *sanctiluciae*—about equal to

*perplexus*. While the teeth are notably heavier than in *agilis* they do not reach the size shown in *elephantinus*. In *venustus*, the ear, although so much larger than in *agilis*, is, yet, smaller than in *elephantinus*, and furthermore it is much darker in color, almost black, and with but a sparse sprinkling, at most, of white hairs on inner surface.

In order of size of bullae, from small to large, we find this sequence: *agilis*, *perplexus*, *venustus*, *sanctiluciae*, *elephantinus*. *Venustus*, in this respect, is not in the same position that it holds as regards geographical situation; its range is farthest north, but its bullae are smaller than in *elephantinus* and *sanctiluciae*, the ranges of which lie between it and *agilis*, the latter with smallest bullae of all.

*Measurements*.—Eight adult specimens, 6 males and 2 females, from the vicinity of Santa Cruz and Stanford University, show average and extreme measurements, in millimeters, as follows: total length, 316 (306–332); tail vertebrae, 194 (184–203); hind foot, 46 (44.5–47.0); ear from crown, 15.5 [estimated, from dried specimens]; greatest length of skull, 41.6 (41.0–42.0); breadth of skull across bullae, 25.2 (24.2–26.0); spread of maxillary arches, 22.3 (21.6–22.9); greatest length of nasals, 15.6 (15.3–15.8); greatest width of rostrum near end, 4.4 (4.2–4.5); width of maxillary arch at middle, 5.3 (5.0–5.7).

Weights are not available for this species; but an estimate based on body length shows a probable average weight of 80 grams.

*Type locality*.—Santa Cruz, California (Merriam, 1904, p. 142). Type collected by G. B. Badger, March 12, 1893; now no. 51852, Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 62).

*Distribution area*.—Chiefly the Santa Cruz Mountain region, in other words the area south from San Francisco to Monterey Bay and lying west of the Santa Clara Valley and the south arm of San Francisco Bay; but the race also occurs, east of the Santa Clara Valley, on Mount Hamilton, and southeast to northern end of Gabilan Range. Altitudinal range, from near sea level to at least 4000 feet. Life-zone, Upper Sonoran, entering the Transition locally. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. San Mateo County: Jasper Ridge, near Stanford University, 5 (4 in coll. Stanford Univ.). Santa Clara County: Mount Hamilton, 1 (in coll. Stanford Univ.). Santa Cruz County: near Santa Cruz, 26 (22 in Biol. Surv. coll.). Monterey County: Fremont Peak, in north end Gabilan Range, 5 (Biol. Surv. coll.). Total number of specimens examined, 37.

### ***Dipodomys venustus sanctiluciae* Grinnell**

#### **Santa Lucia Mountain Kangaroo Rat**

(Pl. 5, fig. 34; text-figs. R, S, W)

*Perodipus venustus*, Merriam (1904, p. 140), part (Santa Lucia Peak); and, in part at least, of some other authors.

*Dipodomys sanctiluciae* Grinnell (1919b, pp. 204–205) [orig. descr.].

*Diagnosis*.—Similar to *D. venustus venustus*, from which it differs in slightly paler, less deeply cinnamon, dorsal coloration, and in definitely greater inflation of mastoid bullae.

*Comparisons.*—*Sanctiluciae* is decidedly nearer to *venustus* than to any other form of *Dipodomys*, and the differences between these two races are such as to require close inspection. The paler color tone becomes apparent on comparison of series, when the sides in particular are seen to be paler, nearer ochraceous-buff than ochraceous-tawny; the light areas on cheek and between eye and ear are paler, grayish rather than strongly buffy; and there are more of the rather long white hairs on inner surface of pinna. The greater inflation of the mastoid bullae of *sanctiluciae* as compared with the condition in *venustus* is the best character. It is subject to measurement in one way by applying the calipers diagonally from postero-internal "corner" to antero-external "corner"; an average example of *sanctiluciae* (no. 14444) gives 16.3 mm.; of *venustus* (no. 3485), 15.3 mm. Of course "breadth of skull across bullae" is also an index of bullar inflation.

From *elephantinus*, *sanctiluciae* differs markedly in smaller size throughout, in darker coloration (especially about the head, where the cheeks are not nearly so white, the ears are blacker, and the facial arietiform marking is bolder), and in weaker incisors, narrower rostrum at end, smaller bullae, and broader interparietal and supra-occipital.

Of the more southern members of the *agilis* group, *perplexus* approaches *sanctiluciae* nearest in size, especially as regards ear. But *sanctiluciae*, still, shows decidedly greater measurements; also as compared with *perplexus*, the tone of coloration is much darker, and the bullae are much larger. There is a decided gap between the two. If a series of intergrades could be found over appropriately intervening territory between *perplexus* and *sanctiluciae*, not at all a remote possibility, then the latter, and also *venustus*, would be best treated as a subspecies of *agilis*.

*Measurements.*—Six adult specimens, 2 males and 4 females, from Santa Margarita and Jolon, show average and extreme measurements, in millimeters, as follows: total length, 302 (293–315); tail vertebrae, 181 (175–190); hind foot, 45 (44–46); ear from crown, 16 [in each of two specimens accurately measured fresh]; greatest length of skull, 41.9 (41.3–42.5); breadth of skull across bullae, 25.4 (24.9–26.0); spread of maxillary arches, 22.0 (21.4–23.0); greatest length of nasals, 15.6 (15.1–16.1); greatest width of rostrum near end, 4.2 (4.0–4.4); width of maxillary arch at middle, 5.1 (4.8–5.3).

Weight, in grams, of two adults, male and female, from Jolon, taken October 21: 82.0, 87.7 (average, 84.8).

*Type locality.*—Hillside, covered with chaparral and digger pines, one mile southwest of Jolon, Monterey County, California (Grinnell, 1919b, p. 204). Type collected by J. Grinnell, October 21, 1918; now no. 29023, Mus. Vert. Zool.

*Distribution area.*—The Santa Lucia Mountain region, namely the mountainous area of west-central California lying between the Salinas Valley and the seacoast, and between Monterey Bay and San Luis Obispo. Altitudinal range, 900 to 5900 feet. Life-zone, Upper Sonoran, entering the Transition locally. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. San

Luis Obispo County: Santa Margarita, 4. Monterey County: near Jolon, 2; Chalk Peak, 3000 feet, 8; Santa Lucia Peak, 5900 feet, 10 (8 in Biol. Surv. coll.). Total number of specimens examined, 24.

### **Dipodomys elephantinus** (Grinnell)

#### **Elephant-eared Kangaroo Rat**

(Pl. 5, fig. 37; text-figs. I, K, S, W)

*Perodipus elephantinus* Grinnell (1919a, p. 43) [orig. descr.].

**Diagnosis.**—A large sized, very large eared, long-tailed, five-toed kangaroo rat, of moderately dark tone of coloration (near cinnamon-buff). Skull with very large auditory and mastoid bullae, and narrow supra-occipital and interparietal; rostrum heavy and with nasals flaring at ends; maxillary arches relatively narrow and with postero-external angle weakly developed (about as in *agilis*); incisors relatively heavy.

**Comparisons.**—*Elephantinus* is a member of the *agilis* group, extreme in the direction of general size and of degree of inflation of the bullae. Indeed, it is larger than any other species of kangaroo rat in California excepting *ingens* and *deserti*. In great size of ear, *elephantinus* exceeds these two as well as all other species; only *perplexus*, *venustus*, and *sanctiluciae* approach it closely in this regard. The tail is heavily tufted and crested, to an extreme, again, in the *agilis* group. In tone and pattern of coloration, *elephantinus* is distinctly paler and less heavily marked than *venustus*, slightly less so than *sanctiluciae*; it approaches *perplexus* very closely, save that the cheek is whiter, less buffy, and there is much more white between the ear and the eye. A notable feature is the presence in *elephantinus* of numerous rather long (2 to 2.5 mm.) white hairs on the inner surface of the pinna. These are represented in *sanctiluciae* and *venustus*, but in lessening numbers, respectively. The ventral dark tail stripe is narrower than in *venustus*, and the terminal tuft and crest is grayer basally.

In general shape of skull, and narrow spread and weak angulation of maxillary arches, *elephantinus* clearly allies itself with *agilis*. But there are sharp distinctions in other respects—heavy incisors, large bullae, appressed supra-occipital and interparietal, and broad as well as long rostrum, with nasals flaring at ends. In some of these respects *venustus* and *sanctiluciae* approach nearer to *elephantinus*, suggesting that the latter is just one of a series of recently evolved races. Indeed, intergradation may yet be found to take place to the north along the Gabilan Range whereby *elephantinus* will merge geographically with *venustus*. One character, however, is, in so far as available material indicates, unique and perfectly constant. In all adults the nasals flare at their ends, so that a notable constriction appears in the rostrum just in front of where the premaxillaries turn downward to envelop the incisors. This feature of flaring nasals alone sets off *elephantinus* from all other species of *Dipodomys*. The "greatest width of rostrum near end" in *elephantinus* (averaging 4.9 mm.) is exceeded by that measurement in no other species and is equalled, even, only in *ingens*.

Young of *elephantinus* do not show the extreme cranial characters of adults; the bullae are relatively smaller, the supra-occipital and interparietal broader, and the rostrum weaker and not swollen at end. In coloration the young are grayer than adults, especially down the back. Half-grown *elephantinus* are distinguishable externally from *venustus* and *sanctiluciae* of corresponding age by much grayer rather than dusky hued ear, and by less slaty black about the face.

*Measurements*.—Ten selected adult specimens, 5 males and 5 females, from the vicinity of Cook, San Benito County, show average and extreme measurements, in millimeters, as follows: total length, 324 (305–336); tail vertebrae, 197 (183–210); hind foot, 46.8 (44–50); ear from crown, 17.4 (16–18); greatest length of skull, 43.0 (41.7–43.9); breadth of skull across bullae, 26.3 (25.5–26.8); spread of maxillary arches, 23.0 (22.1–23.7); greatest length of nasals, 15.7 (14.9–16.4); greatest width of rostrum near end, 4.9 (4.7–5.3); width of maxillary arch at middle, 5.2 (4.8–5.8).

Weight, in grams, of the same ten specimens, all taken July 8 to 21: 85.2 (79.4–90.7).

*Type locality*.—Cook P. O., Bear Valley, San Benito County, California (Grinnell, 1919a, p. 43). Type collected by Halsted G. White, July 9, 1918; now no. 28511, Mus. Vert. Zool.

*Distribution area*.—The chaparral-covered slopes of the southern part of the Gabilan Range, in the vicinity of the Pinnacles, in San Benito and Monterey counties. Altitude of occurrence so far as yet known, about 1300 feet. Life-zone, Upper Sonoran. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. San Benito County: Cook P. O., Bear Valley, 1300 feet, 27; "Bear Valley," 4 (in Biol. Surv. coll). Monterey County: Stonewall Creek at 1300 feet, six miles northeast of Soledad, 5. Total number of specimens examined, 36.

### **Dipodomys microps** (Merriam)

#### **Small-faced Kangaroo Rat**

(Pl. 5, fig. 36; text-figs. I, R, S, W)

*Perodipus panamintinus*, Elliot (1904, p. 305), part.

*Perodipus microps* Merriam (1904, p. 145) [orig. descr.]; and of most authors.

*Perodipus microps microps*, Miller (1912, p. 274); and of some authors.

*Diagnosis*.—A small sized, five-toed, very narrow-faced kangaroo rat, of pale buffy coloration, and with dark markings reduced and white markings correspondingly extended; ear small; skull with very narrow, constricted, and weakly angled maxillary arches; nasals narrow; incisors not strongly in-curved.

*Comparisons*.—*Microps* is sharply set off by the combination of characters given above from any other kangaroo rat known. Even

its nearest relative, *levipes*, is specifically distinct, by reason of the decidedly larger size and darker coloration of the latter and its much more inflated bullae (fully double the volume of those in *microps*).

*Microps* is closely similar externally to *monoensis*, with which it occurs in the upper end of Owens Valley. Indeed, individual skins have proved practically impossible to tell apart. But cranially there are plenty of absolutely diagnostic characters, as follows: *Microps*, in comparison with *monoensis*, has very much narrower and less prominently angled maxillary arches, much narrower nasals and narrower rostrum as a whole, narrower interparietal and supra-occipital, and straighter, less strongly in-curved, incisors.

From *merriami*, which is of about the same size and general external appearance, and which occurs on common ground with it in the lower portion of Owens Valley and around Victorville, *microps* differs outwardly in having a heavier, broader hind foot, a first toe and claw on hind foot, a thicker tail (shown best in freshly captured specimens), a smaller, dusky-haired ear, and a usually paler tone of coloration. As to skull, in comparison with *merriami*, *microps* has shorter and narrower nasals, much narrower, less prominently angled and less widely spreading maxillary arches, smaller mastoid bullae, broader interparietal and supra-occipital, and heavier, less in-curved, incisors.

*Measurements*.—Ten selected adult specimens, 5 males and 5 females, from the vicinity of Lone Pine and Olancha, give average and extreme measurements, in millimeters, as follows: total length, 261 (244–278); tail vertebrae, 150 (140–168); hind foot, 41 (38–43); ear from crown, 10 (9–12); greatest length of skull, 35.2 (34.4–36.5); breadth of skull across bullae, 22.4 (21.5–23.0); spread of maxillary arches, 18.9 (18.3–19.5); greatest length of nasals, 12.3 (11.9–12.7); greatest width of rostrum near end, 3.4 (3.3–3.6); width of maxillary arch at middle, 3.4 (3.0–3.7).

Weight, in grams, of three examples (2 males, 1 female), taken at Olancha, April 3 to 5: 63.5 (61.1–65.0).

*Type locality*.—Lone Pine, Owens Valley, Inyo County, California (Merriam, 1904, p. 145). Type collected by E. W. Nelson, December 22, 1890; now no.  $\frac{25288}{32701}$ , Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 60).

*Distribution area*.—Owens Valley north from Olancha nearly to Benton, Mono County; also the Mohave Desert in the vicinity of Victorville, San Bernardino County. Altitudinal range, 2700–7700 feet. Life-zone, Lower Sonoran; reaches into lower edge of Upper Sonoran locally. (See map, fig. W.)

The following localities are represented in the material examined, the number of specimens from each place being also indicated. Mono County: McKeever [=Taylor] Ranch, 5200–5500 feet, two miles south of Benton Station, 3. Inyo County: Silver Cañon [near Laws] at 5100 feet, 1; mouth of Silver Cañon, 4800–4900 feet, 3; Mazourka Cañon, 7700 feet, Inyo Mountains, 1; vicinity of Lone Pine, 3700 feet, 20; Olancha, 3650 feet, 3. San Bernardino County: Victorville, 2700 feet, 7. Total number of specimens examined, 38.

**Dipodomys levipes** (Merriam)

## Light-footed Kangaroo Rat

(Pl. 5, fig. 35; text-figs. I, Q, R, S, W)

*Perodipus panamintinus*, Elliot (1904, p. 305), part.*Perodipus microps levipes* Merriam (1904, p. 145) [orig. descr.]; and of authors generally.*Perodipus levipes*, Grinnell (1919a, p. 47).

**Diagnosis.**—A middle sized, five-toed, very narrow-faced kangaroo rat, of dusky tone of coloration and with dark facial and other markings well developed; ear small and with much white showing forth behind it; skull with very narrow, constricted, and weakly angled maxillary arches; bullae greatly inflated, and interparietal and supra-occipital narrowed; incisors relatively short and not markedly incurved.

**Descriptive notes.**—In fresh fall pelage, the dorsal coloration is dull cinamon-buff with much dusky tipping to hairs and the bases of the hairs extensively dark gull gray. On the lower sides the bases of the cinnamon ended hairs are light gull gray, not pure white, as is the case in *mohavensis* for instance; the line of dorso-ventral color demarcation along the sides is thus notably abrupt and striking for a desert species. The ear is deeply dusky save for a gray patch on the end of the fold-over, and the white post-auricular patch which the ear is too small to cover up, consequently shows forth with great brilliance. The eyelids are rather heavily dusky, and the whisker patches are blackish with a connecting bridge of dusky between the two across the tip of the nose. The ankles and sole stripes are blackish. The blackish dorsal and ventral tail stripes are each of them wider than the intervening lateral white stripes. The hairs forming the tail tuft are light grayish at base, dusky ended. The white hip stripes are narrower than in other desert species.

Skins taken in spring are more ochraceous-toned than above described, owing to fading and wear; but the dark areas remain the same; the cheek, area between eye and ear, and spot above eye are less overwashed with dusky and are thus lighter, even whitish. Half-grown young are rather deeply grayish toned, but otherwise similar to adults, save for the usual proportional features accompanying immaturity.

**Comparisons.**—*Levipes* agrees with *microps* in important features of the cranium, namely, in the extreme narrowness of the facial elements and in the relatively straight rather than strongly incurved shape of the incisors as viewed from the side. There are also external features in common—small ear, rather short and thick tail with dusky hued tuft, and broad hind foot with (in all specimens examined) a first digit and claw. For these reasons the two species seem best looked upon as properly falling together to constitute the "*microps* group."

Yet there are decided differences between *levipes* and *microps*, so great and constant as to warrant their recognition as altogether dis-

tinct species. External differences consist in the larger size and darker coloration of *levipes*, with the dark facial markings conspicuous and the blackish tail stripes broader than the intervening white ones (this latter feature the reverse of the usual condition in *microps*). Cranially, *levipes* shows, besides decidedly larger size, very much greater size of mastoid bullae, fully twice the volume of those in *microps*, and the interparietal and supra-occipital are narrower, in some specimens almost completely "pinched out." Indeed, in general appearance, the skull of *levipes* is almost a miniature of that of *deserti*.

In the northern end of the Panamint Mountains, in Inyo County, *levipes* and *panamintinus* are near neighbors; in fact they live in adjacent life-zones. These two species are similar in their rather dark type of coloration, as well as in most other external features; but *levipes* is distinctly the smaller, has a decidedly smaller ear, and much silky white (hairs of the post-auricular white patch) shows behind, above, and below the rim of the ear. This latter proved to be an excellent field character; specimens in the traps were quickly recognizable by this feature. The silky white hairs appear to be actually longer in *levipes*; also in *panamintinus* the larger ear tends to cover up the post-auricular white patch, whatever the extent of the latter.

From *mohavensis*, which has been found to occur with it in the vicinity of Olancho, southern end of Owens Lake, *levipes* differs externally in smaller size, somewhat smaller ear, and duller, less brightly ochraceous tone of coloration, as also by the conspicuous post-auricular white patches just alluded to. *Panamintinus* and *mohavensis* are both, of course, of the strongly "broad-faced" category of *Dipodomys*, so that skulls of *levipes* are instantly distinguishable on the basis of narrowly spreading, slender, and weakly angled maxillary arches.

*Toes*.—Among the specimens of the "*microps* group" no individual has been found showing loss or even notable small size of first claw on hind foot. Two specimens of *levipes*, on the other hand, do show remarkable development of that claw. No. 26951, male adult, from the Panamint Mountains, has this claw on the right foot produced into a sickle-shaped structure with a chord over all of 3.3 millimeters. No. 28451, male adult, from near Olancho, has the claw on the right hind foot similarly over-developed, with a chord of 2.9 mm.

*Measurements*.—Ten adult and subadult specimens, 5 males and 5 females, from head of Emigrant Cañon (in Panamint Mountains) and vicinity of Darwin, give average and extreme measurements, in millimeters, as follows: total length, 276 (265–290); tail vertebrae, 158 (150–173); hind foot, 42 (40–44); ear from crown, 11 (10–12); greatest length of skull, 37.8 (36.7–38.9); breadth of skull across bullae, 24.0 (23.5–24.7); spread of maxillary arches, 19.9 (19.3–20.4); greatest length of nasals, 13.2 (12.6–13.5); greatest width of rostrum near end, 3.8 (3.5–4.0); width of maxillary arch at middle, 3.6 (3.2–3.8).

Weight, in grams, of the same ten examples, three of which were taken September 28, and the rest May 26 to 28 and June 7 and 30: 71.3 (57.3–81.1).

*Type locality*.—"Perognathus Flat, Emigrant Gap" [=near B.M. 4899, two miles northwest of Harrisburg, on U.S.G.S. Ballarat Quadrangle, edition of March, 1913], Panamint Mountains, Inyo



County, California (Merriam, 1904, p. 145). Type collected by Vernon Bailey, April 16, 1891; now no.  $\frac{27176}{34575}$ , Biol. Surv. coll., U. S. National Museum (Lyon and Osgood, 1909, p. 60).

*Distribution area*.—Territory of moderate altitude lying east of Owens Valley, and extending north into Nevada; westernmost station, Olancha, Inyo County; southernmost, head of Emigrant Cañon, Panamint Mountains, Inyo County. Altitudinal range, 3600–5300 feet. Life-zone, Lower Sonoran in its upper portion. (See map, fig. W.)

The following localities in California are represented in the material examined, the number of specimens from each place being also given. Inyo County: head of Emigrant Cañon, 4900 feet, Panamint Mountains, 22; Lee Flat, 5200–5300 feet, 15 miles north of Darwin, 25; Lee Mine, 5200 feet, 12 miles north of Darwin, 1; Darwin, 4800 feet, 5; near Olancha, 3600–3900 feet, 2. Total number of specimens examined, 55.

### *Dipodomys deserti* Stephens

#### Big Desert Kangaroo Rat

(Pl. 4, fig. 28; text-figs. E, P, S, X)

*Dipodomys deserti* Stephens (1887, p. 42, pl. 5) [orig. descr.]; and of authors generally.

*Dipodomys deserti helleri* Elliot (1903, p. 249) [orig. descr.]; and of authors.

*Dipodomys deserti deserti*, Miller (1912, p. 277).

*Diagnosis*.—A very large, four-toed, very pale-colored kangaroo rat; no dark ventral tail stripe, but tail conspicuously white tipped; no dark facial markings; no dusky stripe on sole of hind foot. Skull of extreme narrow-faced type, and with enormously inflated bullae; supra-occipital and interparietal so extremely appressed in most specimens as to be eliminated from dorsal view by the swollen mastoid bullae.

*Pelage*.—Remarkably long and silky even for a kangaroo rat. In complete fresh fall coat, typical hairs on rump, where longest, 24 millimeters long; on top of head, 14 mm. long; on belly, 12; on chin, 6. Longest of the vibrissae, 71 mm. long, and extending back along sides of body about two-fifths the distance from their bases to root of tail. Ear pretty well covered with fine hairs up to 3 mm. in length. Hairing of fore and hind feet about as in *agilis*; soles and sides of hind toes more heavily haired, resulting in a condition recalling that of the hind foot of the snowshoe rabbit; longest of these hairs, 5 mm. long. Tail completely clothed with close set short hairs; length of those on basal half of tail, about  $2\frac{1}{2}$  mm. (length the same clear round, dorsally as ventrally); terminal tuft and crest moderately developed, the latter beginning about two-thirds distance from base to tip; longest hairs of tuft, 31 mm. long.

*Coloration*.—In adult, after completion of fall molt: pelage of whole lower surface of body from tip of nose to base of tail, also the

lining of cheek-pouch, cheek, large spot over eye, large patch around hinder and lower base of ear, fore leg and foot, entire hind foot, stripe across thigh, and whole lower surface of tail clear to end, clean white. Upper surface of body from top of nose to base of tail, pale ochraceous-buff, delicately over-washed with dusky; demarcation along sides forward to lower level of eye, rather sharp; small patch on outer side of each thigh, separated by white stripe from color of dorsum, plain light buff, this color extending down on outside of leg and fading out just short of ankle; general color tone of ear like back; area between eye and base of ear, buffy white; eyelids dusky; fine long hairs above and behind eye dusky; whiskers mostly dusky, anterior-most shorter ones white; a little pale buff extends down from top of nose to bases of whisker tufts, but there is otherwise no indication of the dusky or blackish facial markings so characteristic of most species of kangaroo rats. A sharp dorsal tail stripe, about as wide as one-fourth circumference of tail, same color as dorsum, but (as usual in kangaroo rats) not continuous with dorsum, being separated at base of tail by an interval of pure white; distally, at about two-thirds distance toward tip of tail, this dorsal tail stripe darkens to dusky drab, which color, however, stops abruptly about 25 millimeters from tip of longest hairs, leaving the end of the tail entirely pure white. Pelage down middle of back extensively gray basally, but that on sides just above line of dorsoventral color demarcation, pure white basally; parting of the pelage on mid-dorsum shows the hairs to be light gull gray for the basal two-fifths of their length, then light neutral gray for three-tenths of their length, with the terminal three-tenths pale ochraceous-buff and the extreme tip faintly dusky. Hairs of dorsal tail stripe, white at bases, even those of dark subterminal interval. Some very fine dusky-ended hairs, longer than the rest, are to be detected along sides of body above demarcation line.

*Variations.*—Since there is but one molt in *deserti*, just as with the other species, and that one is in the fall, as spring and summer come on, adventitious changes in the color and quality of the pelage become manifest. In nearly every summer specimen (the pelage then being most worn) more or less yellowing of the dorsal color tone is to be seen. In extreme cases, particularly of specimens from depressions of the desert floor where the soil is strongly alkaline, the color of the whole dorsum is deep ochraceous-buff, while the dark dorsal tail stripe, the subterminal dark interval on the tail, and even the white tail-tip and the white foot-soles are tinged with the same color. So peculiar in color are such extreme examples that Elliot (1903, p. 249) was led to base a new name (*helleri*) upon them, with the type locality Keeler, on the east shore of Owens Lake. A large series of skins is now at hand from the immediate vicinity of Keeler, fortunately taken in fall as well as spring. The specimens taken in fall are mostly in fresh new pelage, exactly like others of the same season from many points in the general range of *deserti*; the spring specimens mostly show the extreme "alkalied" cast of color. One specimen (no. 27099) taken September 24 (1917) is in the midst of the fall molt; the forward half of the body is in fresh *deserti* color of pelage; then comes a broad band of old "*helleri*" color; then the rump is in fresh color again; on the top of the tail, the basal half is "*helleri*,"

then comes a segment of *deserti*, then a small segment of "*helleri*," then one of *deserti*, then one of "*helleri*"; and finally the tip is pure unsoiled white. Such a molting example is altogether convincing of the adventitious nature of the "*helleri*" type of coloration. The quality of the pelage in old worn condition is distinctly more harsh, less silky to the touch, than that in fresh condition. It may be further noted that quite as extreme examples of this type as those from Keeler are at hand from the northwestern arm of Death Valley and from the Amargosa River Valley.

The juvenal pelage of *Dipodomys deserti* is like that of the adult save that it is shorter and less dense, the tail especially being less heavily tufted. The dark interval toward the end of the tail is blacker, the white tip shorter, and in some specimens there is a distinct though very narrow dusky ventral tail stripe leading back about halfway from base of white terminal segment to base of tail, where it fades out. This last feature, appearing as it does only in the young, seems to signify a loss of it in the species secondarily by a process of encroachment of the white side-stripes, this latter process being consistent with the extreme paling of the general coloration. Only a rudiment, as it were, of the ventral tail stripe (present in all other species of kangaroo rats) is present in *deserti*; and this rudiment is shown irregularly and only in the young.

*Remarks.*—Of all the kangaroo rats in California, *Dipodomys deserti* is the most distinct: it is set off farthest in aggregate characters from its nearest relative. And furthermore, in the writer's judgment, it is the least generalized member of the genus, most specialized in the direction in which the kangaroo rats seem to be evolving. The first digit on the hind foot is reduced to a mere vestige of the metatarsal; the bullar inflations reach a maximum development; the "face" of the skull is of the extreme narrow type; and the rostrum is slender. *Hcermanni* might be selected as the opposite extreme, representing the most generalized or primitive manifestation in the genus.

As compared with *agilis* and most other species, *deserti* differs in external appearance conspicuously in much greater size, relatively smaller ear, very pale coloration, lack of dusky facial markings, lack (in adult) of ventral tail stripe, lack of dusky stripe on sole of hind foot, and in presence of white tip to tail.

*Measurements.*—Ten adult specimens, 5 males and 5 females, from Death Valley, Inyo County, show average and extreme measurements, in millimeters, as follows: total length, 342 (305–377); tail vertebrae, 201 (180–215); hind foot, 53 (50–55); ear from crown, 13.5 (12–15); greatest length of skull, 45.6 (42.0–47.7); breadth of skull across bullae, 30.7 (29.1–32.4); spread of maxillary arches, 23.6 (21.7–24.8); greatest length of nasals, 16.6 (15.3–17.9); greatest width of rostrum near end, 4.1 (3.7–4.5); width of maxillary arch at middle, 4.4 (3.6–4.8).

Weight, in grams, in the same ten specimens, which were taken from April 8 to April 19, was as follows: average, 103.3 (82.8–131.0).

*Type locality.*—Mohave River bottom at "upper crossing" on old road from Cajon Pass to Rabbit Springs, 3 or 4 miles from, and opposite, Hesperia, San Bernardino County, California (F. Stephens,

in interview with writer, January 1, 1916). In June, 1919, the place was re-visited and found to be occupied by an alfalfa field, with no signs of the species anywhere in the vicinity (F. Stephens, in letter).

Type collected by Frank Stephens, June 29, 1886, now no. <sup>15629</sup><sub>22522</sub>,  
U. S. National Museum (Lyon and Osgood, 1909, p. 57).

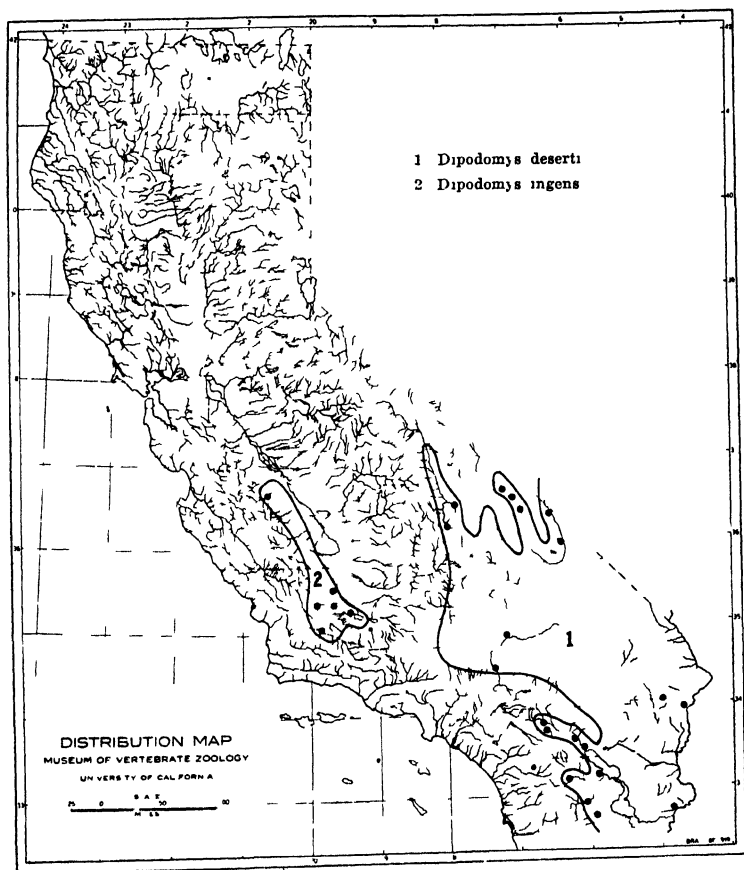


Fig X Map showing stations of occurrence in California of kangaroo rats of the *deserti* group, and of *ingens* of the *heermanni* group, in both cases as established by specimens examined by the author. Assumed general range of each form within the state outlined.

*Distribution area* (in California).—The Colorado and Mohave desert regions, from the Mexican line north to Death Valley and through Owens Valley on east side at least to Alvord, Inyo County (Stephens, 1906, p. 156), west on Colorado Desert to Borego Spring, in eastern San Diego County, and to Palm Springs and Whitewater, Riverside County, and on Mohave Desert to vicinity of Hesperia, San

Bernardino County, and Olancha, Inyo County. Altitudinal range, — 200 to 3900 feet. Life-zone, Lower Sonoran. (See map, fig. X.)

The following localities in California are represented in the material examined, the number of specimens from each place being also indicated. Inyo County: Triangle Spring, Death Valley, 5; Salt Creek, Death Valley, 2; Furnace Creek Ranch, Death Valley, 31; Kelley's Well, Amargosa River, 3; Shoshone, 2; Keeler, 42; Olancha, 4. San Bernardino County: Barstow, 3; Blythe Junction, 1; Mohave River near Hesperia, 1 (topotype from coll. F. Stephens). Riverside County: Colorado River near Riverside Mountain, 1; Whitewater Station, 6; Palm Springs, 7; Coachella, 1 (in D. R. Dickey coll.); Mecca, 36. San Diego County: Borego Spring, 2 (in coll. Stanford Univ.). Imperial County: Colorado River near Pilot Knob, 8; Coyote Well, 3; Salt Creek, 2; Carrizo Creek, 2 (1 in D. R. Dickey coll.). Total number of specimens examined from California, 162.

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*Transmitted April 6, 1921.*



## PLATE 2

Faces of six species of the genus *Dipodomys* to show varying development of the "arietiform" facial marking: 5, *D. morroensis*; 6, *D. heermanni golonensis*; 7, *D. h. tularensis*; 8, *D. nitratoides nitratoides*; 9, *D. merriami merriami*, 10, *D. m. simulus*. All close to natural size.



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### PLATE 3

Dorsal views of the skulls of Californian species of kangaroo rats. All natural size, that is,  $\times 1$ .

Fig. 11. *Dipodomys heermanni californicus*, no. 13680, ♂; Scott River, Siskiyou County; June 13, 1911.

Fig. 12. *Dipodomys heermanni eximus*, no. 18349, ♀; Marysville Buttes, Sutter County; August 5, 1912.

Fig. 13. *Dipodomys heermanni heermanni*, no. 18408, ♀; Carbondale, Amador County; March 25, 1912.

Fig. 14. *Dipodomys heermanni berkeleyensis*, no. 28770, ♀; Berkeley, Alameda County; November 30, 1918.

Fig. 15. *Dipodomys heermanni dixon*, no. 23613, ♂; Lagrange, Stanislaus County; December 18, 1915.

Fig. 16. *Dipodomys heermanni tularensis*, no. 28487, ♀; Earlimart, Tulare County; May 20, 1918.

Fig. 17. *Dipodomys heermanni goldmani*, no. 29373, ♂; Seaside, Monterey County; January 31, 1919.

Fig. 18. *Dipodomys heermanni jolonensis*, no. 29102, ♂, San Lucas, Monterey County; November 20, 1918.

Fig. 19. *Dipodomys heermanni swarthi*, no. 14438, ♂; Carrizo Plain, San Luis Obispo County; May 25, 1911.



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#### PLATE 4

Dorsal views of the skulls of Californian species of kangaroo rats. All natural size, that is,  $\times 1$ .

Fig. 20. *Dipodomys morroensis*, no. 29050, ♂; Morro, San Luis Obispo County; September 27, 1918.

Fig. 21. *Dipodomys mohavensis*, no. 28419, ♂; Mohave, Kern County; March 13, 1918.

Fig. 22. *Dipodomys leucogenys*, no. 26932, ♂; Benton, Mono County; September 20, 1917.

Fig. 23. *Dipodomys stephensi*, no. 2481, ♂; Riverside, Riverside County; September 7, 1908.

Fig. 24. *Dipodomys panamintinus*, no. 26873, ♂; Panamint Mountains, Inyo County; October 1, 1917.

Fig. 25. *Dipodomys ingens*, no. 16671, ♀; Cuyama Valley, San Luis Obispo County, April 25, 1912.

Fig. 26. *Dipodomys ordii monoensis*, no. 26997, ♂; Benton, Mono County; September 19, 1917.

Fig. 27. *Dipodomys ordii columbianus*, no. 11240, ♀; Vinton, Plumas County; August 15, 1910.

Fig. 28. *Dipodomys deserti*, no. 27055, ♂; Death Valley, Inyo County; April 8, 1917.



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## PLATE 5

Dorsal views of the skulls of Californian species of kangaroo rats. All natural size, that is,  $\times 1$ .

Fig. 29. *Dipodomys agilis perplexus*, no. 5395, ♂; Mount Pinos, Ventura County; July 15, 1904.

Fig. 30. *Dipodomys agilis agilis*, no. 9495, ♀; San Fernando Valley, Los Angeles County; October 30, 1903.

Fig. 31. *Dipodomys agilis simulans*, no. 7361, ♂; Dulzura, San Diego County; March 8, 1909.

Fig. 32. *Dipodomys agilis cabezonae*, no. 7364, ♀; Jacumba, San Diego County; March 21, 1909.

Fig. 33. *Dipodomys venustus venustus*, no. 3678, ♂; San Mateo County, near Stanford University; May 1, 1908.

Fig. 34. *Dipodomys venustus sanctiluciae*, no. 14445, ♂; Santa Margarita, San Luis Obispo County; June 2, 1911.

Fig. 35. *Dipodomys levipes*, no. 26949, ♀; Panamint Mountains, Inyo County; May 28, 1917.

Fig. 36. *Dipodomys microps*, no. 27021, ♂; Lone Pine, Inyo County; June 13, 1917.

Fig. 37. *Dipodomys elephantinus*, no. 28524, ♀; Bear Valley, San Benito County; July 13, 1918.



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## PLATE 6

Figs. 38-43. Dorsal views of the skulls of Californian species of kangaroo rats. All natural size, that is,  $\times 1$ .

Fig. 38. *Dipodomys merriami simiolus*, no. 23938, ♂; Palm Springs, Riverside County; February 3, 1916.

Fig. 39. *Dipodomys merriami merriami*, no. 27125, ♂; Death Valley, Inyo County; April 4, 1917.

Fig. 40. *Dipodomys merriami parvus*, no. 2540, ♂; San Bernardino, San Bernardino County; October 2, 1908.

Fig. 41. *Dipodomys nitratoides nitratoides*, no. 14277, ♂; Tipton, Tulare County; April 26, 1911.

Fig. 42. *Dipodomys nitratoides brevinasus*, no. 28642, ♂; Mendota, Fresno County; June 16, 1918.

Fig. 43. *Dipodomys nitratoides exilis*, no. 19065, ♂; Fresno, Fresno County; April 22, 1898.

Figs. 44-49. Posterior views of the skulls of Californian species of kangaroo rats. All  $\times 1$ .

Fig. 44. *Dipodomys agilis agilis*, no. 9495, ♀.

Fig. 45. *Dipodomys stephensi*, no. 2481, ♂.

Fig. 46. *Dipodomys mohavensis*, no. 28419, ♂.

Fig. 47. *Dipodomys heermanni berkeleyensis*, no. 28770, ♀.

Fig. 48. *Dipodomys heermanni goldmani*, no. 29373, ♂.

Fig. 49. *Dipodomys heermanni jolonensis*, no. 29102, ♂.



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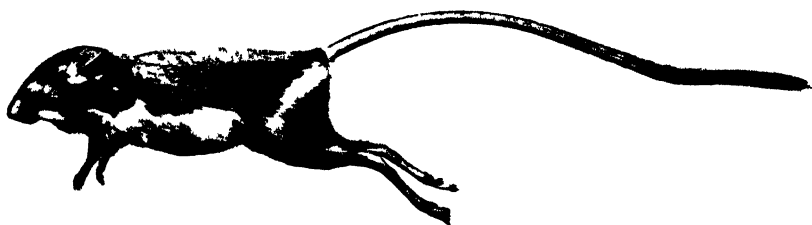
#### PLATE 7

Fig 50. *Dipodomys heermanni dixonii*, ♂ adult, no 23613, Lagrange, Stanislaus County; December 18, 1915; photograph from fresh animal, before preparation as specimen;  $\times \frac{2}{3}$ .

Fig. 51. *Dipodomys heermanni tularensis*, ♂ subadult, no. 25171, Dunlap, Fresno County; September 28, 1916; photograph from freshly caught animal;  $\times \frac{1}{2}$ .

Fig. 52. *Dipodomys heermanni tularensis*, ♀ juvenal, no. 28478; Caliente Creek Wash, Kern County; May 13, 1918, photograph from fresh animal,  $\times 1$ . Although weighing but 13.5 grams, and therefore less than one fifth adult weight, the main generic features of external structure and coloration are in evidence. The tail, however, is relatively under-developed as to length and terminal hairing, and the feet are overdeveloped.

These three photographs serve to show the more prominent external characters of the genus *Dipodomys*. (See p. 10 )





Young of the Bohemian waxwing (*Bombycilla garrula pallidiceps*) just out of the nest. Figure 1 from specimens collected near Telegraph Creek July 5 1919. Upper female lower male. The young bird possesses the same wing and tail markings as does the adult with the yellow areas more vivid the inside of the mouth is brilliantly colored.

**BIRDS AND MAMMALS OF THE STIKINE  
RIVER REGION OF NORTHERN BRITISH  
COLUMBIA AND SOUTHEASTERN ALASKA**

**BY**

**H S SWARTH**

**(Contribution from the Museum of Vertebrate Zoology of the University of California)**

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# BIRDS AND MAMMALS OF THE STIKINE RIVER REGION OF NORTHERN BRITISH COLUMBIA AND SOUTHEASTERN ALASKA

BY  
H S SWARTH

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## INTRODUCTION

In years past the Museum of Vertebrate Zoology has conducted several expeditions to the coast of southeastern Alaska, covering in all a large part of that district, and one to Vancouver Island, British Columbia, nearby and of somewhat similar character.<sup>1</sup> As one result of this field work the Museum has obtained a representative collection of the birds and mammals of this strongly characterized northwestern coast region of North America. Of the closely adjacent interior of British Columbia, however, the Museum contained no specimens whatever.

In a general way it has been understood that the faunas of the coast and of the interior are markedly different, that the boundary between the two is sharply defined, and that this boundary lies very near to the coast. It is obvious that collections could be made over a relatively limited area and still include a strip of country extending from the one region to the other. Such an expedition would supply series of specimens of species new to the Museum collections or but scantily represented therein, and would also provide valuable data regarding distribution, especially with respect to the behavior of animal forms at the margins of their habitats.

The valley of the Stikine River seemed to satisfy all requirements. It crosses the boundary between the two faunal areas, and, piercing the formidable barrier of mountains that intervenes, affords a feasible route from one region to the other. Furthermore, we already had extensive series of birds and mammals from the country about the mouth of the river, to supplement whatever collections might be made farther up stream. Dr. J. A. Allen (1903) had published a report upon a collection of mammals from the upper Stikine region, made by A. J. Stone and M. P. Anderson, but this collection had been gathered to the eastward of the debatable strip that we especially desired to explore.

The expedition thus outlined was made possible through the generous provision by Miss Annie M. Alexander, founder of the Museum of Vertebrate Zoology, of a sufficient sum to defray the cost, this in

<sup>1</sup> Previous field work on the northwest coast has been prosecuted as follows: in 1906 on the Kenai Peninsula; in 1907 in the Sitkan district; in 1908 in the Prince William Sound region; in 1909 in the Sitkan district; and in 1910 on Vancouver Island.

addition to her regular yearly appropriation for the maintenance of the Museum. Miss Alexander had long been especially interested in the natural history of Alaska and British Columbia and had herself personally participated in previous field work carried on in those regions by this Museum.

Our party consisted of two, the writer and Mr. Joseph Dixon, Economic Mammalogist of the Museum. Mr. Dixon collected most of the mammals and took entire charge of the photographic work, making this an important feature of the trip. He also supplied most of the notes regarding the nesting activities of various species of birds. The writer collected most of the birds, and worked with the mammals enough to enable him to better understand local conditions. The material collected consists of 534 mammals, 638 birds, 24 sets of birds' eggs (mostly with nests), 70 amphibians, 195 photographic negatives. The present report is concerned with the mammals and birds; the amphibians are not included.

In treating the birds I have followed the nomenclature of the American Ornithologists' Union (*Check-List* (1910) and its supplements (1912, 1920), with some modifications. I have made no attempt to be "up to date" in the adoption of the scores of changes proposed of recent years, not yet acted upon by the Committee and regarding which I have no new facts to offer or upon which I cannot form an independent opinion. There are certain cases, however, dealing mostly with matters of ornithology rather than nomenclature, where the presentation of new facts or a new point of view, or the conviction of the correctness of the course of some previous writer, at variance with the *Check-List*, impels me to the use of names not included in that standard. This, it seems to me, is proper. These changes are thus formally presented for consideration, but their general adoption by others prior to action of the Committee is not expected, any more than I, myself, expect at once to adopt other changes regarding which I can have no personal knowledge. I have endeavored in every case at variance with the *Check-List* to indicate my reason for adopting the name in question. With mammals there is no such standard, and the opinion of the latest monographer of a group is usually accepted.

My sincere acknowledgments are due to a number of institutions and individuals for aid of one sort or another. For the prosecution of the field work I was generously granted by the following authorities permission to collect specimens of birds and mammals: the United States Biological Survey and the Dominion Parks Branch, Department

of the Interior, Canada, for the taking of migratory birds; the United States Department of Agriculture, for game mammals in Alaska; the United States Department of Commerce, for fur-bearing mammals in Alaska; Mr. F. Kermode, Director of the Provincial Museum, Victoria British Columbia, for game and non-game birds and mammals in British Columbia.

I am under obligations to the Bureau of Biological Survey of the United States Department of Agriculture, through its chief, Dr. E. W. Nelson, for the loan of specimens, for the identification of certain species, and for the determination of the contents of bird stomachs. In this connection particular mention should be made of the identification of the shrews of the genera *Sorex* and *Microsorex* by Dr. Hartley H. T. Jackson, who examined all my material except four specimens in alcohol; and of the examination of a considerable number of birds' stomachs by Mr. Charles C. Sperry.

From the Victoria Memorial Museum, Ottawa, through Mr. P. A. Taverner, and from the Provincial Museum, Victoria, British Columbia, through the director, Mr. F. Kermode, I received the loan of specimens of various species of birds.

The plant names used in this report were supplied by Dr. F. J. Smiley, of the University of California Herbarium, based upon specimens collected on this expedition that have been deposited in the Herbarium.

Advice and information was received from Mr. Ernest P. Walker, an employee of the United States Bureau of Fisheries who was stationed at Wrangell, Alaska, at the time we were pursuing our field work in that region. Mr. Walker supplied data on certain species from the vicinity of Wrangell, and he has presented to the Museum of Vertebrate Zoology specimens of birds and mammals from the same region that are desirable additions to the Museum collection.

I take pleasure in expressing my gratitude to Mr. W. H. Dodd, government agent at Telegraph Creek, for assistance and advice during our stay in the region over which he has jurisdiction.

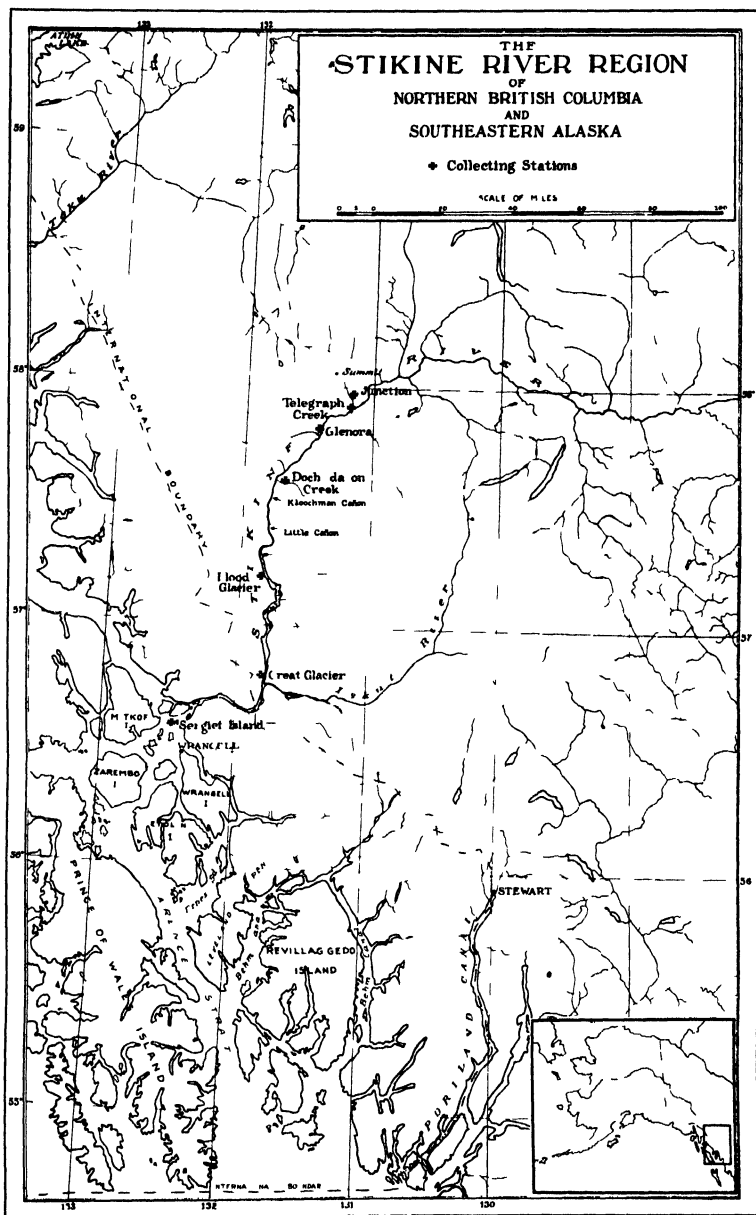


Fig. A. Map of the lower Stikine River, British Columbia and Alaska, showing stations from which collecting was carried on by the 1919 expedition from the Museum of Vertebrate Zoology.

## ITINERARY AND DESCRIPTIONS OF LOCALITIES

From Berkeley we proceeded directly to Telegraph Creek, the head of navigation on the Stikine River. There we made arrangements with the Barrington Transportation Company, whereby their river boat, running on fairly regular schedule, deposited us at various selected camp sites. Our collecting stations were carefully chosen, both with regard to their location on the river, and to the accessibility of stretches of surrounding territory. The last item is of importance in a wilderness as generally impenetrable as are the forests of the lower Stikine.

Our itinerary, in detail, was as follows: left Berkeley, May 14; left Wrangell, Alaska, May 21; arrived Telegraph Creek, B. C., May 23; The Junction, May 25 to June 6; Telegraph Creek, June 6 to 26; Glenora, June 27 to July 8; Doch-da-on Creek, July 8 to 26; Flood Glacier, July 26 to August 8; Great Glacier, August 8 to 16; Sergief Island, August 17 to September 7; Mitkof Island, August 26 to 29; arrived Berkeley, September 15.

## TELEGRAPH CREEK

The town of Telegraph Creek is on the north bank of the Stikine River, about 130 miles from, and 540 feet above, tidewater (Brooks, 1906, p. 49). It is about 160 miles from the general line of the coast at the mouth of the river, following the course of the stream; less than half that distance in an air line from the nearest point on the coast. Telegraph Creek, the stream, flowing from the north, empties into the river at this point. Near the town the river banks rise steeply on either side to a series of terraces beyond. At many points these enclosing walls are sheer cliffs of basaltic rock, several hundred feet high, with long steep taluses extending below, sometimes to the river's edge. Telegraph Creek, for the last mile or two of its course, flows along a narrow cañon, the steep walls rising abruptly to the level terraces above. In its upper reaches it follows a cañon the walls of which are not particularly steep. The stream has its source in a string of lakes at "the Summit," some twelve miles north of the point where it empties into the Stikine, at an altitude of about 2600 feet. The mountains rise to a much greater height on either side. About two miles northwest of the town of Telegraph Creek is Sawmill Lake, about a mile long. Four or five miles farther west lies the much larger Alkali Lake.

In the Telegraph Creek region the principal feature of the vegetation is the poplar woods. Poplars grow everywhere in the lowlands, sometimes in almost pure stands with but a sprinkling of other trees, and for miles in extent. In swampy places willow thickets form dense growths that are hard to penetrate. On some of the drier ridges these willows form open woods that are quite easy to traverse, composed of rather large trees, widely spaced and with little brush below. At some points there are stretches of dry, gravelly benches, with a sparse growth of small lodgepole pines (*Pinus contorta*) and here and there a few cottonwoods, birches, and poplars, with very little undergrowth and all together very park-like in appearance.



Fig. B. Looking down the Stikine River from a point about a mile below Telegraph Creek, just above the junction of the First South Fork. The Stikine today follows the same general course to the sea as it did before the present coastal ranges were elevated; the river valley was cut deeper and deeper during the slow uplift of the mountain barrier. In the Telegraph Creek region, here shown, the valley consists of a series of sharply defined terraces, rising step by step from the river to the bases of the mountains on either side. These terraces presumably indicate the level of the river at different periods of its history. Photograph taken June 24, 1919.

The valley on the north side of the river, extending west and south at least as far as Glenora, is relatively level with a few low hills and ridges here and there, stretching from the abrupt banks that border the river up to the higher mountains some miles to the northward. This rolling country is nearly all covered with forest of poplar, willow, cottonwood, and birch, and a few scattered pines. In places the woods are quite dense, sometimes fairly open; some of the hills and ridges are

quite destitute of trees. There are occasional small lakes, and here and there marshes and small streams.

On the drier slopes and ridges two species of juniper occur, *Juniperus communis* var. *sibirica* and *Juniperus horizontalis*, both to be seen in abundance from the river bank up to the Summit. Both species grow as rather low, rounded bushes. On the higher mountain slopes are groves of spruce and balsam fir, extending downward in cool, shaded cañons, as along Telegraph Creek, or occurring sometimes as

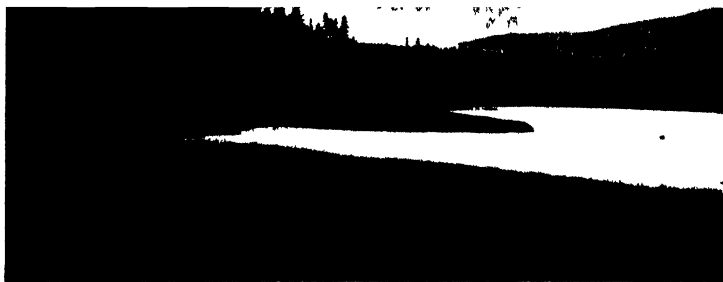


Fig. C. East end of Sawmill Lake, near Telegraph Creek. Mammals that especially frequent the grass and bushes about the shores of the lake are shrews (*Sorex personatus personatus* and *S. obscurus obscurus*), Drummond meadow mouse, and Stikine jumping mouse. Birds that nest amid the same surroundings are the spotted sandpiper, alder flycatcher, rusty blackbird, rusty song sparrow, and Forbush sparrow. The lesser yellowlegs was seen feeding about the shores of the lake, but apparently was not nesting there. Grebes, loons, and ducks were seen daily upon the lake during June and probably were nesting. Photograph taken June 20, 1919.

small, isolated clumps on some north-facing slope well down in the poplar forest.

Of low-growing shrubbery, a conspicuous plant of the drier slopes is *Shepherdia canadensis* (locally known as soapberry), which forms dense thickets of considerable extent. The berries are an important bird food. The wild cherry (*Prunus demissa*) was another noticeable plant, forming dense thickets along the banks of the stream near the town, the bushes from three to six feet high and, by the middle of June, a mass of white flowers. The service berry (*Amelanchier florida*) grows abundantly, forming bushes from four to ten feet high,

and also blooms before the middle of June. Wherever land had been cleared and allowed to go back to a wild state, there were dense growths of lupine.

#### THE JUNCTION

Years ago a road led from Glenora, skirting the base of the hills and joining the trail from Telegraph Creek at the Junction, four miles from the Stikine, up Telegraph Creek. The old road has long been in disuse, and most of it is now a poorly defined trail, used by moose



Fig. 1) Type of country seen in the lowlands of the Telegraph Creek region. The terraces extending from the Stikine River northward to the mountains are covered mostly with poplar woods. Here and there clumps of spruce occur, with occasional groves of lodgepole pine. At the time this photograph was taken, May 26, 1919, and at the point shown, near the base of the hills, the poplars had not yet leaved out, though four miles to the westward, near the river, the trees were green with foliage. Telegraph Creek, the stream, flows along the bottom of the narrow cañon in the foreground.

This is the habitat of moose, bear, and red squirrel, among mammals, of Hammond flycatcher, Cassiar junco, robin, hermit thrush, and long tailed chickadee, among birds.

and other wild animals, but seldom by man. At the Junction there is a small meadow by the side of the stream, and there we camped. Just above this point the hills begin to rise rather abruptly.

The Junction was our first collecting station. In some respects we would have done better to have stayed near the river, for though the distance was short and the altitude at the Junction but little higher, there was an appreciable difference in temperature between the two places, which was reflected in the plant life and in the birds. While



the air was warm on the Stikine, and most of the trees and bushes well leaved out, at the Junction the temperature was below freezing each night, and the deciduous trees and shrubbery were all bare or just beginning to show bursting leaf buds. Still higher, at the Summit, the lakes were almost entirely ice covered, and there were deep snow-drifts on all sides. The snow was melting in the daytime, however, and the meadows as a result were nearly all flooded.



Fig. E. Looking up the river from Glenora, fifteen miles below Telegraph Creek. Here there are extensive tracts of open meadow land, much of it covered with grass and wild strawberries, parts of it densely grown up with lupine and fireweed. Bordering river and meadows are rows of tall cottonwoods rising above thickets of alder and willow. Poplar is the predominant tree of the drier ground. The mountains immediately to the eastward are low and rounded, in striking contrast to the high, jagged peaks of the coast range, which rise but a short distance west of this point. Photograph taken July 6, 1919.

#### GLENORA

Fifteen miles down stream from Telegraph Creek, on the west side of the river, lies Glenora, a deserted village. Years ago this was the metropolis of the region, but circumstances caused the entire population to move to Telegraph Creek. The houses were mostly of logs, material that could not be moved, and they stand there today, slowly succumbing to decay, a refuge for white-footed mice and bushy-tailed wood rats.

Glenora occupies a strip of flat ground several hundred yards in width, extending for perhaps a mile along the river, the stream in front, steep banks behind, two or three hundred feet high, rising to a

series of terraces above. This low-lying strip is but slightly above the normal high water mark of the river.

There are extensive tracts of open meadow land, some of it grass covered, other parts densely grown with lupine and fireweed (*Epilobium angustifolium*). The fireweed in particular grows densely and to a great height everywhere about the houses. There are places acres in extent covered solidly with wild strawberry plants. Bordering the meadows and along the river banks are rows of tall cottonwoods



Fig F The Stikine River just above Grand Rapids, about fifty miles below Telegraph Creek and about 110 miles from the mouth of the river. Here the Stikine begins its passage through the Coast Range, the mountains rising steeply and to great heights on either side. Coastal conditions begin to be apparent, more in the character and density of the vegetation than in the animal life. On the west bank of the river, shown in the photograph, coniferous woods extend down to the water's edge. On the east side poplar and birch prevail, trees that do not extend much farther down stream. Photograph taken July 20, 1919.

(*Populus trichocarpa*), in the wet places are thickets of alder, and elsewhere mixed woods, just as about Telegraph Creek.

Glenora Mountain lies north of the town, rising abruptly from the terraces bordering the river. It is a long ridge, rather than a peak, much of the summit ascending well above timber line.

#### DOCH DA ON CREEK

Some thirty miles south of Glenora is Doch-da-on Creek, flowing into the Stikine from the southeast, just above Grand Rapids. Here is the ranch of Mr. and Mrs. Frank Jackson, where we made our camp.

Doch-da-on Creek emerges abruptly from steep rocky walls at the base of a mountain, then, before reaching the river, flows for about a

mile along a broad, gravelly, rock-strewn wash. Half a mile to the northward, a branch of the Stikine nearly as wide as the main stream enters from the east. This branch is the outlet of a slough that begins some miles farther north and passes behind a series of islands. The Jackson ranch thus occupies a peninsula between the creek and the slough, a low-lying flood plain resulting from the deposits of the creek.

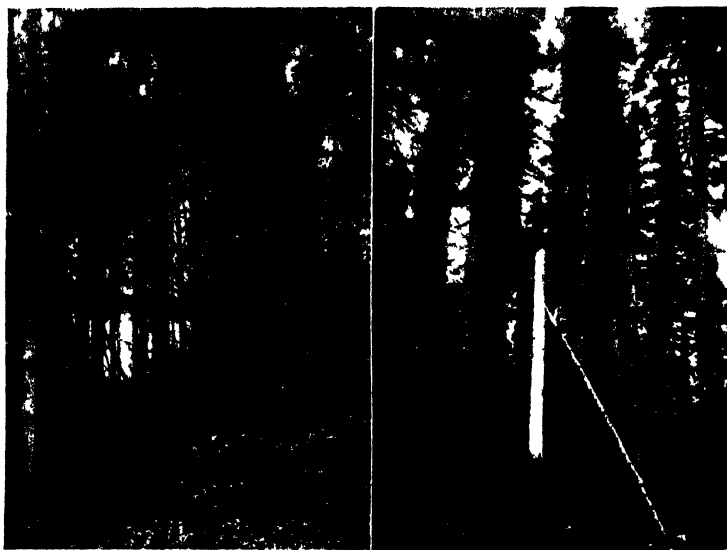


Fig. G

Fig. H

Fig. G. Poplar woods along shore of Sawmill Lake, near Telegraph Creek. Poplars grow quite densely and sometimes in nearly pure stands, though there is often an admixture of willow. Bird species that particularly frequent this type of woods are the ruffed grouse, northern flicker, western warbling vireo, yellow warbler, Tolmie warbler, American redstart, and olive-backed thrush. Photograph taken June 19, 1919.

Fig. H. The spruce woods of the middle altitudes on the mountain sides are made up of large sized trees and occupy a well defined area above an altitude of about 1500 feet. In the woods here shown we saw the goshawk, western winter wren, short-tailed chickadee, ruby-crowned kinglet, Alaska hermit thrush, and northern varied thrush. At the upper edge of the timber the Fleming grouse was seen. Photograph taken on mountain above Doch-da-on Creek, July 23, 1919.

On the east side of the river the mountains lie back a mile or more from the stream, rising by alternate stretches of rather gentle slopes and much steeper pitches, to ridges far above timber line, probably 4000 feet altitude and higher. On the west side of the Stikine, just

opposite, rocky walls rise abruptly from the water's edge; exposed granite cliffs and steep, forested slopes reach to a height of perhaps 1500 feet, then a stretch of gentler slopes ascends to the base of the higher mountains beyond.

Vegetation here is of the interior, but the underbrush is much denser than we found it farther up the river. Alder thickets cover large areas of the bottom lands and poplar groves the lower slopes of the hills. Fir (*Abies amabilis*) grows in abundance down to the level of the river, forming groves of considerable extent, mixed with



Fig. I. Stikine Valley from Flood Glacier; view toward the river from the front of the glacier. The opening in the foreground, the present terminal moraine, owes its snowy appearance to the white, glacier-polished rocks with which the ground is strewn; there was no snow at that level. The ridge in the middle distance is on the far (east) side of the Stikine. On the upper slopes of the distant mountains there is a series of hanging glaciers, with running streams descending from each one. Photograph taken August 1, 1919.

some spruce. There are also cottonwood, willow, and birch, all growing to large size, and, of smaller trees, mountain ash (*Sorbus sitchensis*) and maple (*Acer douglasii*).

On the mountainside above we found a well defined belt of spruce timber of large size, above that a belt of scrubby and prostrate balsam (*Abies lasiocarpa*), and still higher an area that is destitute of any trees or bushes, given over to heather, moss, and grasses.

## FLOOD GLACIER

Flood Glacier is on the west side of the Stikine, approximately fifteen miles below the Little Cañon, and about seventy miles from the coast. Its terminal moraine is about two miles back from the river. Our camp here was below the southern end of the glacier, on a knoll by the river frequently used as a camp site and locally known as "the barley cache." We found ourselves here amid conditions very similar to those on the seacoast, in a dense forest of spruce and hemlock, with thickets of alder and devil's-club in the wet places and of

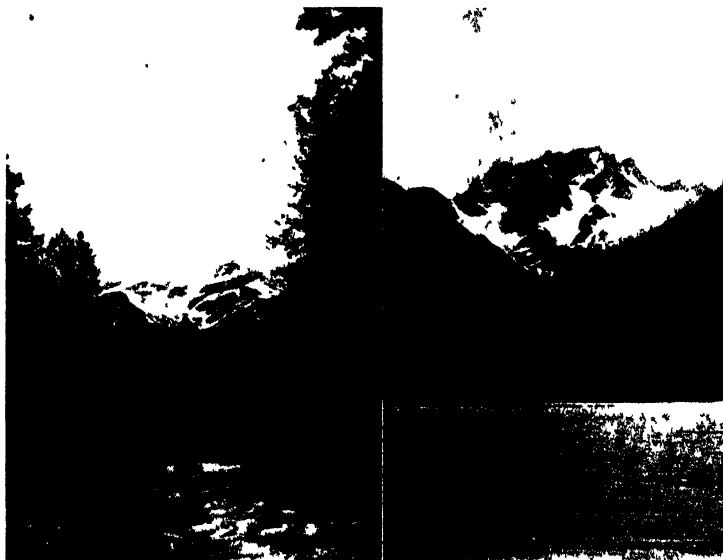


Fig. J

Fig. K

Fig. J. Clearing through the forest below Flood Glacier. The woods here are so dense as to be all but impassable. Immediately below the glacier, however, there are several straight, open lanes, extending down nearly to the river's edge, apparently ploughed through the woods by descending masses of ice or rocks. These lanes are used as avenues of travel by moose and bear, as indicated by the tracks. We also found far more small birds in such openings than in the surrounding woods. Photograph taken August 1, 1919.

Fig. K. Mountain opposite Great Glacier at its southern extremity. This point, some thirty miles from the sea, is in the heart of the Coast Mountains; the peaks and ridges here seen form the very backbone of the range. The higher crests, jagged and unworn, apparently never were glacier-covered. The sheet of ice may be seen today, below the summit of the range, extending for many miles as a series of disconnected hanging glaciers, all at about the same level. (See also fig. I.) According to Indian legend, an ice bridge extended across the Stikine at the point here shown at a not very remote time. Photograph taken August 9, 1919.

huckleberry in the drier woods. The only open ground was found in some long, narrow lanes extending down from below the glacier, where apparently strips of forest had been swept away by avalanches of ice or rocks.

The moraine consists of huge, angular rocks massed in ridges and is largely hidden by forest growth, which extends close to the glacier. Large spruce and hemlock trees grow between the rocks, and devil's-club, salmonberry, and other shrubbery cover the surface of the boulders. Most of the depressions were flooded by beaver ponds, with surrounding borders of alder.



Fig. L. Mouth of Stikine River at low tide. The ocean tides ascend many miles up stream. At low water extensive sand bars are exposed at the river's mouth; the channel is then broken up into numerous small, shallow passages, impassable to even a very small boat. Photograph taken at Sergief Island, Alaska, September 5, 1919.

#### GREAT GLACIER

The fanlike front of the Great Glacier, four or five miles across, issues from the mountains on the west side of the Stikine about fifteen miles above the British Columbia-Alaska boundary line. Our camp site was below the southern end of the Glacier. The river bank at that point is rather high and abrupt, cut through a deep layer of gravel that extends back to the terminal moraine of the glacier. This dry, well drained strip is not of a nature to support such forest growths as we found below Flood Glacier, and the woods were fairly open. There are extensive areas grown with scattered thickets of alder and a few scattered spruce and cottonwoods, the open ground between being

covered everywhere with thick, soft lichens, carpet-like in their effect. On strips of damper ground nearby the spruce forest had secured a foothold, with the accompanying tangle of devil's-club and alder underneath.

Immediately below the glacier, fed by the melting ice, a string of little ponds extends, barren of vegetation and surrounded by low, rounded hills of gravel and rocks. Streams issuing from these ponds flow over gravelly beds to the river, a mile or more distant.

#### SERGIEF ISLAND

This islet lies at the mouth of the Stikine, about eight miles north of the town of Wrangell. The main rocky mass of the island is about a mile in its greatest diameter. On the north and east sides, toward the river, there is a flat belt of sandy soil, half a mile or more across, that lies at a level above even the highest stage of river or tide at the present time. This strip has some timber upon it, cottonwood, spruce, alder, and willow, but is mostly grown with tall grass and pea vines. The river flows close to the island. There are no mud flats on the east side, but extensive sand bars are exposed at low tide. The rocky backbone of the island rises abruptly from the surrounding marsh, and is covered with the dense forest growth characteristic of the Sitkan district. Spruce is predominant in the woods, with tangled undergrowth beneath, in which devil's-club is most prominent. At the edge of the woods is a fringe of alder, these bushes diminishing in size and density as salt water is approached. At the upper edge of the tidal flats the alders give way to scrubby willows, which extend far out on the marshes, over much of the ground that is not regularly inundated by the tides. Alders and willows together form a relatively narrow strip surrounding the island, and beyond the last straggling bush the grass-covered marsh land extends. Part of this marsh land is covered by salt water every day, part of it only by the highest tides. Large areas are covered by the marsh grass to the exclusion of all other vegetation; in places it grows taller than a man's head. Toward the higher ground, where there is much fresh water, this tall, coarse grass is absent, and there is a covering of shorter growths, composed of a number of different plants. This higher area is dotted with small ponds, some surrounded by reeds. Beyond the margin of the marsh grass are the bare mud flats, exposed only at low tide. The marshes throughout are intersected by numerous channels, of varying depth and width, extending upward from the low water mark in many cases clear to the rocky center of the island.

Sergief Island is the home of Mr. W. E. Parrott, who has cleared a small tract of land and for some years has successfully raised garden vegetables and ginseng. We established our camp in a cabin in the woods about a mile from his place. From Sergief Island, Dixon, in company with Mr. Parrott, made a four days' trip to Blind Slough, Mitkof Island, ten or twelve miles to the westward.



Fig. M. Sand flat at eastern end of Sergief Island, Alaska. On that side of the island, deposition of sediment from the Stikine has resulted in the building up of a strip of sandy soil that now lies above the level of the highest stage of river or tide. This strip is grown up with tall grass and pea vines. At the landward margin there are bordering thickets of alder and willow, and groves of cottonwood. Beyond, steep slopes arise, covered with spruce. The tall grass was the haunt of the rusty song sparrows. The bordering thickets at the time of our visit harbored numbers of migrants, such as the golden-crowned sparrow, Oregon junco, lutescent and Townsend warblers, dwarf hermit thrush, north-western robin, and varied thrush. Photograph taken August 20, 1919.

## TOPOGRAPHY OF THE REGION AND ITS BEARING UPON ANIMAL LIFE

The Stikine River rises in northern British Columbia east of the Coast Range and flows southerly and westerly to the Pacific. Its headwaters interlock with those of the Liard and with streams that flow into the Yukon. Thus, the height of land that traverses northern British Columbia serves as a divide between several great river systems. The Liard flows northeastward through the Rocky Mountains to the Mackenzie, which flows into the Arctic Ocean; the Yukon flows north-



westward to Bering Sea; on the west, the Taku, Stikine, and Skeena rivers follow parallel courses westward through the Coast Range to the Pacific. Headwaters of all these streams rise from nearby points in northern British Columbia.

For some distance from its source the Stikine flows from east to west, following fairly closely the 58th parallel of latitude, and receiving from time to time tributaries of considerable size. In the Telegraph Creek region the river gradually turns, first toward the southwest, then almost due south. Some twenty miles from the coast, about at the British Columbia-Alaska boundary, it bends sharply to the westward once more, and reaches salt water near the town of Wrangell, amid the network of islands forming the Alexander Archipelago.

A tributary of importance to the upper Stikine is Clearwater Creek, entering from the northwest some thirty miles below Telegraph Creek. Near the Boundary there is a small stream that is locally called "Clearwater Creek," and there is apt to be confusion between the two if the facts are not known.

Our work did not take us above the middle Stikine Valley, with its uppermost limit at Telegraph Creek. In this section, from Telegraph Creek down stream nearly to Doch-da-on Creek, the valley is rather broad, the mountains rising at a distance on either side. Just south of Doch-da-on Creek the Stikine begins its passage through the Coast Range. The valley, already much narrowed, becomes still more constricted; some five miles below Doch-da-on Creek the river is hemmed in between the rocky walls of Kloochman Cañon, the uppermost of the two narrow gorges through which the Stikine passes in the lower part of its course. The mountains from this point on become much higher and more precipitous. From Doch-da-on Creek looking northward and eastward the valley is broad in extent and the mountains are relatively low and rounded. Many of the summits are bare of snow during the summer months. To the southward and westward a jumbled mass of jagged peaks and ridges arises, forbidding in the extreme, and pressing closely in upon either side of the river.

Where the Stikine passes through the mountains, the river valley is exceedingly rough and covered with a forest that is virtually impenetrable. In this connection it is of interest to quote some statements of Emmons (1911, pp. 9-10) in his description of the country of the Tahltan Indians, who occupy the region of the upper Stikine.

The lower valley of the Stikine from just below Glenora to the coast, a direct distance of about eighty miles, is included within the coastal range and constitutes a region of great humidity, with leaden skies and an annual precipitation

equalling if not exceeding that of the coast which reaches a mean of eighty-six inches. The snowfall thereabouts is excessive, and accounts for the extensive glaciers that fill the valleys; and long after spring has opened in the colder interior the lower river flats are covered with their burden of snow and ice . . . . Forests of spruce, fir, cedar and hemlock cover the mountain slopes to the limit of tree growth, while in the river valleys cottonwoods grow to considerable size, and groves of alder and willow, with the devil's club and berry bushes, form an almost impenetrable barrier. . . . It may be pertinent to remark here, that this region which may be characterized as the wet belt has never been inhabited by either Tahltan or Tlingit in the sense that they have permanently occupied it and it is scarcely more popular as a hunting ground owing to its poverty and inaccessibility.

At the mouth of the river and in the channel beyond there are numerous small rocky islands. Surrounding these centers there are miles of meadow, marsh land, and mud flats, resulting from the deposition of silt by the river. During the period of high water in mid-summer the stream is gray and opaque with silt carried in suspension, and this silt has been dropped in the channels immediately beyond the river's mouth until they are well-nigh filled.

A conspicuous forest tree of the lower Stikine is the cottonwood. This tree covers all the low ground near the water, grows densely and to a large size. It finds a foothold on sand bars and aids in the building up of such areas into more stable bottom land. Consequently, there are hundreds of acres of cottonwood in almost pure stands but slightly above the level of the river or even submerged at the highest water. East of the Coast Range, cottonwood is much less conspicuous than along the lower river, though still persisting in considerable numbers.

In the country in general at the mouth of the Stikine, the Sitka spruce is the dominant tree. This tree, with other associated conifers, extends some distance up stream, forming an evergreen forest that covers all but the unstable bottom land where the quick-growing cottonwoods occur. Where rocky slopes rise abruptly from the river's bank, the conifers range down to the water's edge. The higher ground back from the first bottom is covered densely with woods of spruce and hemlock, and with undergrowth of devil's-club, alder, and huckleberry. Such woods extend with but slight breaks to a point a little above the Little Cañon. Farther inland the spruce woods ascend higher and higher on the mountain sides, until at Doch-da-on Creek the lower limit of this belt lies at an altitude of about 2000 feet. Somewhere below Doch-da-on Creek the Sitka spruce of the coast gives way to other conifers of the interior, but just where this happens we did not ascertain. On the upper Stikine, poplar becomes the dominant growth of the valley, mixed, here and there, with groves of conifers or of cottonwood.

The Sitkan district of southeastern Alaska is characterized by excessive humidity and by relatively equable temperature. The annual rainfall at many points is 100 inches or more, the number of rainy days per year around 200. There is a great deal of foggy and cloudy weather. The winters are not extremely cold nor are the summers very warm. The vegetation of this region is comprised mostly of an extremely dense growth of coniferous forest trees, and, beneath the trees, underbrush almost tropical in its luxuriance. The Sitkan district is here considered as including the islands between Cross Sound and Dixon Entrance, together with a narrow strip of the adjacent mainland coast. Its eastward limits are sharply defined by the towering and precipitous range of mountains that, rising abruptly from the shore, parallels the coast. To the eastward of this Coast Range, in the interior of British Columbia and Alaska, is a region of widely different character. I have not exact meteorologic data for this section, but certain general facts are obvious. Dawson (1889, pp. 58b-59b) remarks on this subject as follows:

It may be stated here, as showing the broad general contrast, that while the annual precipitation at Wrangell, at the mouth of the Stikine, is over sixty inches, that in the vicinity of Telegraph Creek on the inland side of the mountains, is so small that it is necessary to irrigate cultivated land. Nor does this comparison of rain fall sufficiently mark the great diversity which actually obtains between the two climates, the prevalence of clouded skies in the coast region being accompanied by a saturated state of the atmosphere, while precisely opposite conditions are found on the eastern side of the mountain belt, at not more than eighty miles inland from the general line of the coast.

The country east of the mountains is subject to far greater extremes of temperature than the coast region, with hot summers and with extremely cold winters. The forest covering includes a considerable proportion of conifers, but there is also a still larger proportion of deciduous timber. The animal life in these two regions, the Sitkan district of the coast and the adjacent interior, is widely different.

The valley of the Stikine forms a highway between the two faunal areas, otherwise separated by physical barriers and sharply contrasted in nearly all particulars, though lying in close juxtaposition. The presence of this channel of communication affords excellent opportunity for observation of the geographic behavior of the many animal species that by this means are permitted an outlet in either direction. Certain contrasted species and subspecies occupying comparable positions in each of the two faunal areas are brought together, and thus into competition; others with no such direct rival in the adjacent area are brought into contact with climatic conditions, adverse in that they are unaccustomed.

The Stikine is one of several large rivers of the northwest that break through the Coast Range at right angles to the lines of those mountains, their valleys thus lying transverse to the main lines of the range. In a published report upon the geology of Alaska, A. H. Brooks (1906) makes the following statement regarding the Copper, Alsek, Taku, and Stikine rivers: "These, together with the other large rivers of British Columbia, seem to traverse the coastal mountain barrier along valleys determined by antecedent conditions. Their lower valleys at least have the same direction as before the present coastal mountains were elevated, and the streams maintained their courses across the barrier during the slow uplift" (p. 286). Again: "The valleys of the Stikine and Taku rivers, . . . which lie transverse to the Coast Range, have probably inherited their courses from a former mature drainage system which was developed on the old peneplain" (*loc. cit.*, p. 287).

In this connection it is worth while to note the appearance of the river valley of the upper Stikine in the Telegraph Creek region. There, and for many miles down stream from that point, the stream is bordered by series of terraces, rising step by step to the base of the mountains beyond. Viewed from some overlooking height the course of any one of these terraces may be traced for a long distance. It seems obvious that they represent the level of the river valley at different periods of its history. (See fig. B.)

The evidence of the geologist goes to show that, diverse as the coast region and the interior are, as regards fauna and flora, the two have not been absolutely separated by the Coast Range at all times in the past any more than they are at present. A channel of communication through the mountains has been there continuously from very remote geologic times, save for a period when it must have been blocked by ice.

Presumably all animal life was swept from both regions when the whole country was glacier-covered. Presumably, too, conditions in the areas on either side of the Coast Range permitted the return of animals and plants from the southward when the mountains between were still mostly ice. Even now the range is glacier-covered over a large portion of its area. The higher peaks and ridges protrude, steep and serrated, far above the ice. From the jagged, unworn appearance of these higher crests they apparently never were covered. The sheet of ice as seen today lies below the summit of the range, and can be traced as a series of hanging glaciers appearing and re-appearing for many miles at about the same level, visible from the river below. In certain cañons and valleys, tongues of this glacial covering extend downward

far below the general level, some of them to within a mile or two of the river. It cannot be such a very long period of time since ice blocked the entire valley. In fact, there are today legends among the Tahltan Indians of a time when an ice bridge still extended across the Stikine at the Great Glacier, connecting ice masses that are now perhaps four or five miles apart. Of course, as remarked by Dawson (1889, p. 53b) about this same tale, it is impossible to determine whether "this is a remembered fact or a fancied inference." (In this connection see also Emmons, 1911, p. 15.)

The hypothesis of a glacial blockade of communication between the interior and the coast would imply the separate derivation of the animal life of each. That is, that there was invasion from the southward on either side of the coast range, of the same or of different species, as the case might be. Doubtless, at a still later period, there was invasion of certain species from the northward as well. Among birds in particular detailed comparisons may be made (see fig P), and upon comparing the avifauna of the interior and of the coast in the Stikine region, it will be seen that not only are comparable ecologic niches on either side of the mountains usually filled by different species rather than subspecies, but that frequently the species are not especially closely related. Furthermore, among the few cases where two subspecies of a species do occur abundantly on either side of the mountains, there is hardly an instance where we were able to trace intergradation along the connecting valley of the Stikine. In some few cases where the birds were abundant enough for us to ascertain the fact, it was evident that certain subspecies, at this particular point, met as distinct species. All this argues for invasion from the southward, on either side of the Coast Range, of bird species and subspecies that met at a much later period along such channels as the Stikine Valley.

The intrusion of a range of high mountains was productive of diverse climatic conditions in the two regions. This, in turn, resulted in differences in the reestablished plant and animal life to a far greater extent than would follow from the mere presence of a physical barrier such as a mountain mass. Differences of temperature and of humidity arose, so that at the present time the two areas, east and west of the Coast Range, respectively, form strongly contrasted faunal areas (dependent upon relative humidity), and they are somewhat different zonally (dependent upon temperatures).

At a considerably later period than that at which the regions on either side of the mountains became habitable, conditions in certain

of the river valleys traversing the barrier (as the Stikine) became such as to permit the existence of animal and plant life, and various species extended their ranges up or down such channels of communication, as circumstances permitted. One factor that may be of present importance in limiting the use of the Stikine Valley as such a channel, so far as birds are concerned, is the late advent of summer conditions on the lower Stikine compared with the regions on either side, a seasonal tardiness that unquestionably prevents the nesting of many species in this intermediate strip at the time of their arrival from the south. (In this connection see Dawson, 1889, p. 59*b*; Emmons, 1911, pp. 9-10.)

The general hypothesis outlined seems to accord with conditions as we now see them. Among birds it may be pointed out that it is consistent with the manner of occurrence of forms like *Hylocichla ustulata ustulata* and *H. u. swainsoni*, closely related subspecies of one species but behaving at this point like two distinct species. It is consistent with the extension inland a certain distance of forms like *Sphyrapicus varius ruber* and *Passercella iliaca fuliginosa*, and toward the coast of *Piranga ludoviciana* (see Swarth, 1911, p. 95) and *Empidonax traillii alnorum*, and it is consistent with the restriction on one side or the other of such distinct and sharply delimited forms as *Bombycilla garrula pallidiceps* and *Cyanocitta stelleri stelleri*.

In this connection, certain facts regarding the present-day migration of birds in the region should be considered. If there were any general travel between the interior and the coast such river valleys as the Stikine would be the highways most generally followed. Our work in the region shows pretty clearly that such is not the case. It seems evident that the birds of the interior travel north and south almost entirely east of the coast ranges. Some of them, it is well known, even pass east of the Rocky Mountains as they get farther south. Birds of the coastal region remain west of the mountains.

We found many characteristic inland species of birds, some breeding, others, perhaps, merely migrants, as far down stream as Great Glacier, some thirty miles from the coast. The species seen there include *Penthestes atricapillus septentrionalis*, *Setophaga ruticilla*, *Hylocichla ustulata swainsoni*, and *Vireosylva gilva swainsoni*, none of which has been taken on the coast. *Dendroica aestiva* was an abundant migrant, though almost entirely absent at the mouth of the river. The Stikine in its passage through the Coast Range travels almost due south, and it is natural that birds from the headwaters should migrate in numbers along this valley. It is not so clear why

they should not arrive at the mouth. However, a short distance below the Great Glacier, about at the boundary, the stream turns sharply to the westward. Just above this bend is the mouth of the Iskut, a tributary of the Stikine that is nearly as large as the main stream. At the point of junction the broad valley of the Iskut enters from the southeast and its course is east and west for some distance. A perfectly feasible outlet is thus afforded for migrating birds from the northward at just the point where the Stikine Valley would lead them astray. I do not know that this is the course that is actually followed, but it may very well be, and if so it serves to explain the absence at the mouth of the river of species that were migrating southward in numbers at a point some thirty miles up stream.

There are, however, certain inland species that appear to migrate regularly coastward, though doubtless in lesser numbers than go directly south. *Dendroica coronata hooveri* has been taken in the fall near the mouth of the Taku River (Swarth, 1911, p. 99), and we obtained it at the mouth of the Stikine, each time in sufficient numbers to appear to be of regular occurrence. *Sialia currucoides* has been found near the mouth of the Taku under similar circumstances (Swarth, *loc. cit.*, p. 112), and while we, ourselves, did not meet with this species at the mouth of the Stikine, specimens have been taken there.

The question arises as to the migration of such species as *Melospiza melodia rufina* and *Passerella iliaca fuliginosa*, coastal forms primarily but breeding far inland up the Stikine. Whether or not they ascend and descend the river in their travels is not clear, and the facts will be difficult to ascertain.

The casual occurrence at the mouth of the Stikine in the spring of such species as *Myadestes townsendi* and *Sialia currucoides* (see pp. 301, 309) is noteworthy. Such wanderers in the fall might be explained as individuals that had mistakenly followed the river to its mouth. In the spring, they can not be regarded as having gone astray. The fact that they had reached this point is evidence that they were confidently traveling to a definite goal, though along a path not usually followed by their kind.

At high water, quantities of drift are carried down the river. It is probable that small mammals living in the bottom lands often take refuge in fallen trees or in masses of brush that are suddenly floated away, and are thus transported far down the river. This may be one factor tending toward the more general extension coastward of inland species as compared with the sharper restriction of coastal forms (see fig. Q).

Thus there are certain species of birds and mammals for which the valley of the Stikine River acts as a channel of communication between interior and coast. There are none to which it acts in the opposite rôle, as a barrier to farther distribution, north or south. It would not to birds, of course, in any event. As regards mammals, conditions here are very different from what, for example, they are in the valley of a stream like the Colorado River, of the southwestern United States. In that region, not only the river itself but also the wide strips of adjacent bottom lands absolutely prevent the passage of certain desert mammals, so that there are a number of species and subspecies restricted to one side or the other (cf. Grinnell, 1914).

In the Stikine Valley no local conditions ("associations") exist that tend to keep certain groups of animals either close to or far distant from the river banks, and the same forms range unhindered from the water's edge well up the mountain sides. For a period of months the river is frozen over quite to its mouth, and there is no doubt that at that season individuals of many species of mammals cross from one side to the other.

## ZONAL AND FAUNAL POSITION OF THE STIKINE VALLEY

The Sitkan district of southeastern Alaska has been generally considered to be mostly of the Canadian life zone. The areas that extend above timber on the higher mountains afford a strip of Alpine Arctic of considerable extent, and a drawback to the recognition of the lower altitudes as Canadian is the absence of any well defined intervening strip of Hudsonian. Some birds and mammals that occur elsewhere in the Canadian zone do occur in the lowlands of the Sitkan district, but on the other hand species generally regarded as indicative of the Hudsonian zone are found throughout the whole region. Altogether it seems as though all the Sitkan district below Alpine-Arctic should be considered as of the Hudsonian zone, with a strong infusion of Canadian in the southern part at least. Certainly this coastal strip is of a higher life zone than the adjacent interior.

In the country immediately east of the Coast Range there has not been sufficient work to permit detailed mapping of the life zones. The most recent zonal map covering that section is the one published in the A. O. U. *Check-List* (1910, pl. 1) and is on too small a scale to permit of much detail. On that map the Hudsonian zone covers practically all of northern British Columbia, extending considerably farther southward there than in southern Alaska, to the westward, or



in northern Alberta, to the eastward. The adjacent coastal strip of southeastern Alaska is indicated as Canadian, and there are narrow strips of Canadian extending inland along certain river valleys, of which the Stikine is one. The interior is thus regarded as of a higher zone than the coast. This is not in accordance with our own findings. One of the rules upon which life zones are based is as follows: "The northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction" (Merriam, 1898, p. 54). Exact figures are lacking for the region we visited, but there can be no doubt that the summer temperature of the country immediately east of the mountains is appreciably higher than on the coast. In further illustration of the relative zonal positions of the two regions, the following lists of some characteristic summer birds of the lowlands should be considered.

## COAST

*Dendragapus obscurus sitkensis*  
*Cyanocitta stelleri stelleri*  
*Nannus hiemalis pacificus*  
*Regulus satrapa olivaceus*  
*Regulus calendula grinnelli*  
*Ixoreus naevius naevius*

## INTERIOR

*Bonasa umbellus umbelloides*  
*Buteo swainsoni*  
*Nuttallornis borealis*  
*Spizella passerina passerina*  
*Vireosylva gilva swainsoni*  
*Setophaga ruticilla*

Furthermore, in the course of our work the interesting fact was developed that certain species of birds that occur commonly at sea level on the coast occur inland at constantly increasing elevations. Ascending the Stikine it is noticeable, at a point about a hundred miles inland, that the characteristic spruce forest found at sea level on the coast and on the banks along the lower reaches of the river, here begins to ascend the mountain sides, its place in the valley being taken by the poplar woods. In the Telegraph Creek region we found the spruce belt at an altitude of perhaps 1500 to 2000 feet, and found therein the bird species to which reference is made. It is an additional complication that whereas certain subspecies extend unchanged from the coast to the interior as inhabitants of this spruce belt, some species are represented by different subspecies at the two extremes. *Nannus hiemalis pacificus* and *Regulus satrapa olivaceus* belong in the first mentioned category. In the second, *Dendragapus obscurus sitkensis*, *Regulus calendula grinnelli*, and *Ixoreus naevius naevius*, of the coast, appear to be replaced in the interior by *Dendragapus obscurus flemingi*, *Regulus calendula calendula*, and *Ixoreus naevius meruloides*. Among mammals, *Marmota caligata* is one conspicuous species that occurs at sea level on the coast (*M. c. caligata*) and at high elevations inland (*M. c. oxytona*). It is a matter for regret that we were unable to give

more study than we did to the fauna of the spruce belt of the interior mountains, for our data are admittedly scanty; but at any rate it is evident that the bird population, at least, of that region contains a large proportion of forms that are characteristic of lower levels at the coast. The presence of the several animal and plant species noted serves for the recognition of a strip of Hudsonian zone on the mountain



Fig. N

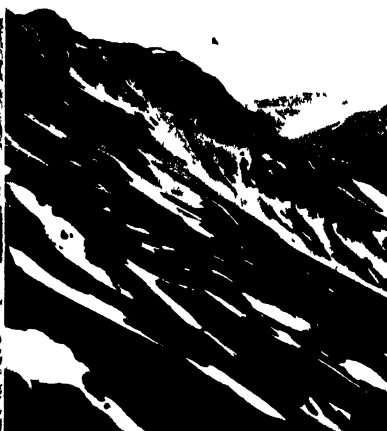


Fig. O

Fig. N. Ascending the mountains, the poplar woods are gradually left behind while spruce and fir, appearing first as scattered thickets on north-facing slopes or in cool cañon beds, gradually become the dominant forest growths. This, the Hudsonian zone, is the home of the Canada jay, pine grosbeak, golden-crowned sparrow, and golden-crowned kinglet. Photograph taken in the upper reaches of Telegraph Creek, looking toward the Summit, June 28, 1919.

Fig. O. Above the spruce woods is a strip of dwarfed and prostrate balsam fir; still higher, Alpine Arctic slopes and ridges extend that are bare of trees but well covered with grass, heather and moss. This timberless area is the home of the mountain goat and marmot, among mammals; of white tailed ptarmigan, pallid horned lark, Hepburn rosy finch and pipit, among birds. Photograph taken on the mountain above Doch-da-on Creek, July 23, 1919.

sides, as distinguished from the Canadian zone of the valley below. There are certain birds, apparently all of high altitudes inland, of which we learned regrettably little regarding their relationship to the coast fauna. They are as follows: *Canachites canadensis osgoodi* is believed to be mainly a bird of the spruce belt on the mountains.

*Perisoreus canadensis canadensis* was quite through nesting when we reached the region, but presumably does not breed in the valley near the river. *Pinicola c. flammula* appeared to belong to the spruce belt, but this is doubtful. *Zonotrichia coronata* is in this latitude unquestionably a high mountain species, reaching its greatest abundance in the scrubby balsam at timber line. The unsettled question concerns its extension coastward. In the coast region it does not occur in the lowlands, but may occur on the mountains. *Spizella monticola ochracea* is a high mountain bird in the Telegraph Creek region, probably near the southern limit of the bird's distribution.

We ourselves did not get far back from the Stikine Valley at any point, and it might be argued that our finding there of certain species not extending into the Hudsonian is no more than corroborative of the narrow line of Canadian extending along the Stikine Valley, shown in the zone map cited. However, recent work has been done in the interior at Hazelton and at Atlin, which shows the general distribution of the bird species to which reference is made; on this basis it seems altogether likely that northern British Columbia should be regarded as predominantly of the Canadian life zone rather than of the Hudsonian.

It seems worth while to make such comparisons as are possible of the results attained by the other ornithological work recently done in northern British Columbia. Taverner (1919) has reported upon a collection of birds from Hazelton, and E. M. Anderson (1915a) upon a collection from Atlin. The three points, Atlin, Telegraph Creek, and Hazelton, are about the same distance inland. Atlin is about 150 miles north of Telegraph Creek, near the head of the Taku drainage, Hazelton about 225 to the southward, on the upper Skeena. The three localities are thus very similarly placed as regards their relation to the coast.

Species common to Atlin, Telegraph Creek, and Hazelton:

1. *Bonasa umbellus umbelloides*
2. *Falco sparverius sparverius*
3. *Colaptes auratus borealis*
4. *Chordeiles virginianus virginianus*
5. *Selasphorus rufus*
6. *Nuttallornis borealis*
7. *Myiochanes richardsoni richardsoni*
8. *Empidonax hammondi*
9. *Empidonax wrighti*
10. *Perisoreus canadensis canadensis*
11. *Euphagus carolinus*
12. *Spinus pinus pinus*

13. *Zonotrichia leucophrys gambeli*
14. *Spizella passerina passerina*
15. *Tachycineta thalassina lepida*
16. *Dendroica aestiva aestiva*
17. *Penthestes atricapillus septentrionalis*
18. *Hylocichla ustulata swainsoni*
19. *Hylocichla guttata guttata*
20. *Planesticus migratorius migratorius*
21. *Sialia currucoides*

Species common to Atlin and Telegraph Creek, probably finding their southern limit near Telegraph Creek:

1. *Spizella monticola ochracea*
2. *Junco hyemalis connectens*
3. *Dendroica coronata hooveri*

Species common to Hazelton and Telegraph Creek, probably finding their northern limit near Telegraph Creek:

1. *Dryobates villosus monticola*
2. *Cypseloides niger borealis*
3. *Chaetura vauxi*
4. *Melospiza melodia rufina*
5. *Piranga ludoviciana*
6. *Vireosylva gilva swainsoni*
7. *Oporornis tolmiei*
8. *Setophaga ruticilla*

Species found at Atlin and not at Telegraph Creek, probably finding their southern limit between these points:

1. *Surnia ulula caparoch*
2. *Dendroica striata*
3. *Penthestes hudsonicus hudsonicus*

Species found at Hazelton and not at Telegraph Creek, probably finding their northern limit between these points:

1. *Cyanocitta stelleri anneetens*
2. *Junco oreganus shufeldti*
3. *Stelgidopteryx serripennis*
4. *Vireosylva olivacea*
5. *Dendroica auduboni auduboni*
6. *Dendroica magnolia*
7. *Geothlypis trichas occidentalis*

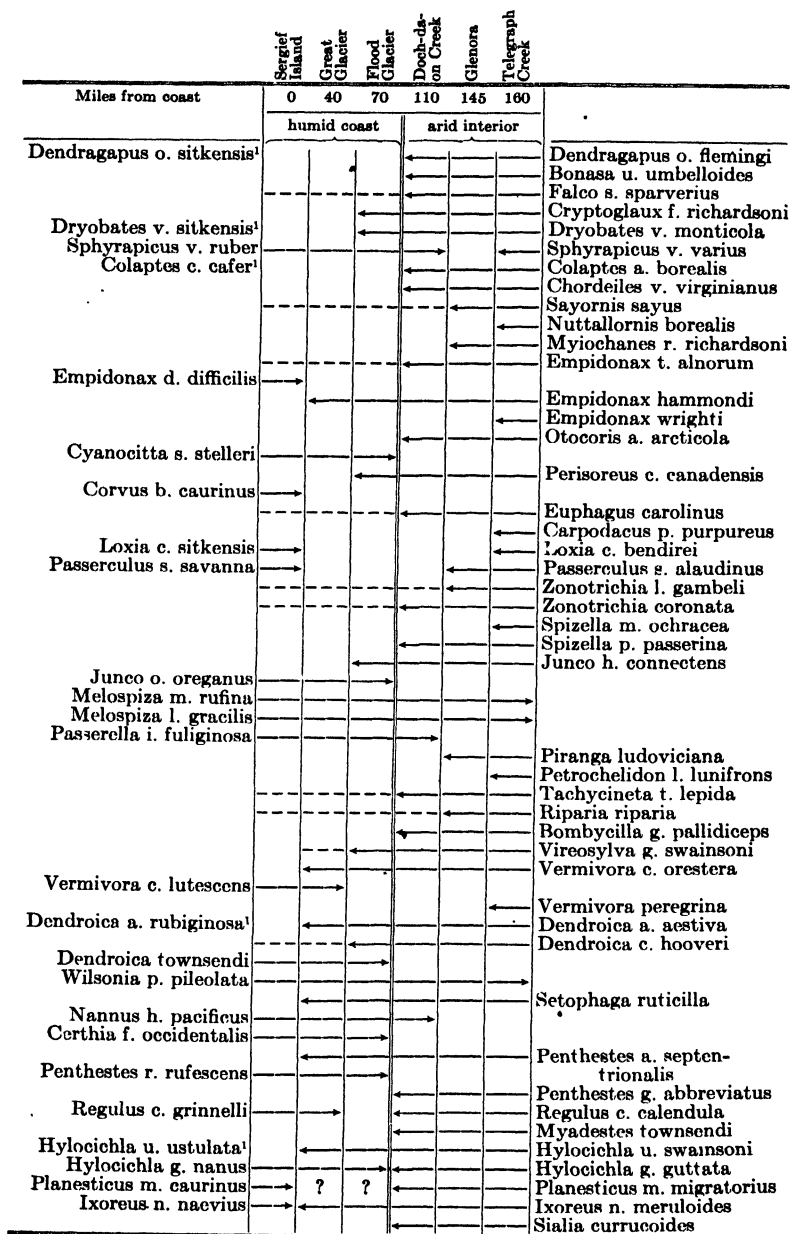
In this discussion of the life zones of the regions involved, so much more information was forthcoming from the birds than from the mammals that more stress is necessarily given to evidence derived from them. A large percentage of the mammals of the interior are of species of which it is difficult to obtain specimens, especially in summer. A number of species we failed to meet with at all, though possibly they

occur in fair abundance, and of others but an unsatisfactory representation was obtained.

As faunal areas, the Sitkan district and the country east of the mountains are strongly contrasted. Differences of humidity are as striking as those of temperature, and these differences are reflected in the mammal, bird, and plant life of the two regions. The peculiarities of the Sitkan district are well known, and the accepted boundaries well defined. Of the country east of the mountains, as typified in the Telegraph Creek region, the peculiarities are equally well marked. This district, of undetermined extent, save where it impinges upon the Sitkan district, appears worthy of a name as a recognizable faunal area, for the sake of convenient reference, at least, and I would suggest the adoption of Cassiar district, a name applied to it as a political division.

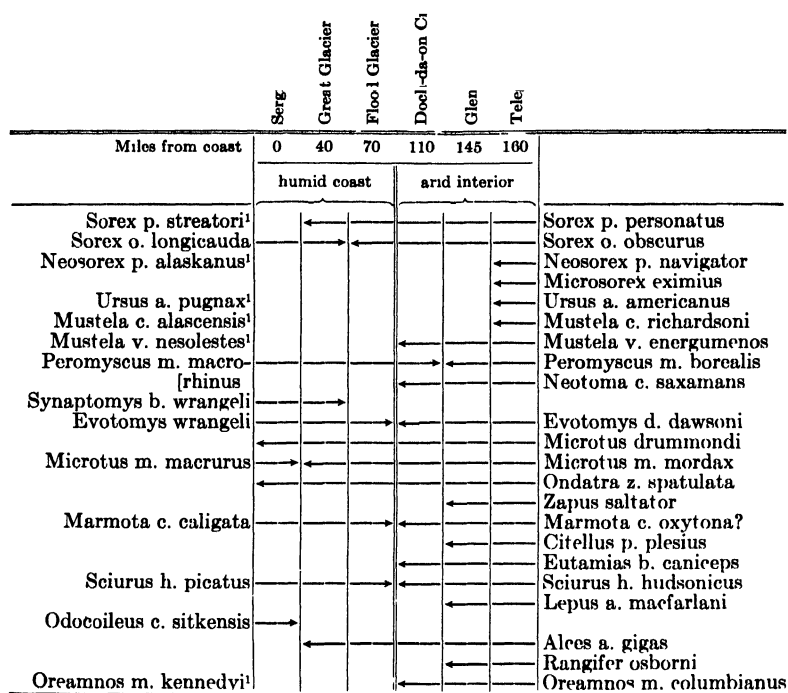
The birds of the two regions are more widely different than are the mammals, that is, there are more distinct types in each region. The two mammal faunas are distinct enough, and there are certain conspicuous species in each district that are not found in the other, but in many cases closely related species or subspecies replace one another on either side of the dividing line. Certain species of which a large representation was obtained (*Peromyscus* and *Microtus*) exhibit intergradation between related forms along the river to an extent far beyond anything found among the birds.

The two accompanying tables, (figs. P, Q) serve to show the relationships of the bird and mammal faunas of the two regions, and the nature of the occurrence of the various species in the Stikine Valley, as observed by us. Certain generalizations may be drawn from these tables. (1) There are, as previously remarked, more distinct types of birds in the two contrasted regions than there are of mammals. (2) There are more bird forms in the interior than on the coast. (In addition, it may be said that bird life, as regards number of individuals, is far more abundant in the interior than on the coast.) (3) In the Stikine Valley, at least, there are a number of species of the interior that extend far toward the coast, while very few coastal races extend any distance inland; the fauna of the Sitkan district is closely confined to the region west of the Coast Range. In certain respects these tables are imperfect. It would take many seasons of field work to fill in gaps in our knowledge that are here apparent. Also, in the case of some species there are differences of altitude concerned (implying zonal differences) as well as those of linear distance, and such distinctions could not be made in this table.



<sup>1</sup>Known to occur on the coast of southeastern Alaska, but not encountered on the lower Stikine by this expedition.

Fig. P. Showing manner of occurrence in summer of certain land birds of the Stikine region. Species and subspecies primarily of the coast are listed in the left-hand column; those of the interior in the right-hand column. The intervening columns indicate collecting stations of the 1919 expedition, from the coast toward the interior reading from left to right, with the approximate distance of each place from the coast. Arrow indicates direction and extent of dispersal of each species from the center of abundance. Broken line indicates occurrence as migrant beyond the breeding limits.



<sup>1</sup>Known to occur on the coast of southeastern Alaska, but not encountered by this expedition

Fig. Q. Showing manner of occurrence of certain mammals of the Stikine region. Species and subspecies primarily of the coast are listed in the left hand column; those of the interior in the right-hand column. The intervening columns indicate collecting stations of the 1919 expedition, from the coast toward the interior, reading from left to right, with the approximate distance of each place from the coast. Arrows indicate direction and extent of dispersal of each species from the center of abundance.

The 127 species and subspecies of birds treated in this report probably form a fairly complete representation of the summer avifauna of the region. It seems curious, though, that we should have seen no three-toed woodpeckers (*Picoides*), no magpies (*Pica*), and no yellow-throats (*Geothlypis*).

Numerous species of the mammals known to occur in the region we did not meet. We caught glimpses of bats on two occasions, but got no specimens. A coyote (*Canis*) is said to range this far north, but we neither saw nor heard one. *Vulpes*, *Martes*, *Gulo*, and *Lynx* are fur bearers that are regularly trapped throughout the region. Whether or not there are seasonal differences affecting local distribution we did

not learn, but we did not come in contact with any of these species. Sheep (*Ovis stonoi*) occur in the neighboring mountains, of course; we were not within their territory. Flying squirrels (*Glaucomys*) occur, we were told by trappers, but we saw none. *Phenacomys constablei* was described from Telegraph Creek, but our trapping did not produce a single specimen.

#### CHECK LIST OF THE MAMMALS

1. *Sorex personatus personatus* I. Geoffroy
2. *Sorex obscurus obscurus* Merriam
3. *Sorex obscurus longicauda* Merriam
4. *Neosorex palustris navigator* Baird
5. *Microsorex eximius* (Osgood)
6. *Ursus*, species?
7. *Ursus americanus americanus* Pallas
8. *Canis occidentalis* Richardson
9. *Mustela cicognani richardsoni* Bonaparte
10. *Mustela vison energumenos* (Bangs)
11. *Phoca richardi richardi* (Gray)
12. *Peromyscus maniculatus borealis* Mearns
13. *Peromyscus maniculatus macrorhinus* (Rhoads)
14. *Neotoma cinerea saxamans* Osgood
15. *Synaptomys borealis wrangeli* Merriam
16. *Eutamias dawsoni dawsoni* Merriam
17. *Eutamias wrangeli* Bailey
18. *Microtus drummondi* (Audubon and Bachman)
19. *Microtus mordax mordax* (Merriam)
20. *Ondatra zibethica spatulata* (Osgood)
21. *Mus musculus musculus* Linnaeus
22. *Zapus saltator* Allen
23. *Erethizon epixanthum nigrescens* Allen
24. *Marmota caligata caligata* (Eschscholtz)
25. *Citellus plesius plesius* (Osgood)
26. *Eutamias borealis caniceps* Osgood
27. *Sciurus hudsonicus hudsonicus* (Erxleben)
28. *Sciurus hudsonicus picatus* Swarth
29. *Castor canadensis canadensis* Kuhl
30. *Lepus americanus macfarlani* Merriam
31. *Odocoileus columbianus sitkensis* Merriam
32. *Alces americanus gigas* Miller
33. *Rangifer osborni* Allen
34. *Oreamnos montanus columbianus* Allen



## GENERAL ACCOUNTS OF THE MAMMALS

**Sorex personatus personatus** I. Geoffroy. Masked Shrew

Obtained only in the vicinity of Telegraph Creek and at Great Glacier. Seven taken at Telegraph Creek and five at the nearby station of the Junction (nos. 30527, 30535, 30554–30559, 30561, 31052–31054). Seven specimens from Great Glacier (nos. 30544, 30562–30567), though referred to *Sorex personatus personatus*, show intergradation toward *S. p. streatori*. These determinations, as well as those of the other forms of *Sorex* and *Microsorex* here treated, were made by Dr. Hartley H. T. Jackson, of the United States Biological Survey.

**Sorex obscurus obscurus** Merriam. Dusky Shrew

Seven specimens taken at the Junction, five at Telegraph Creek, three at Glenora, two at Doch-da-on Creek, and one at Flood Glacier (nos. 30522–30526, 30528–30534, 30536–30541). Shrews were nowhere abundant.

**Sorex obscurus longicauda** Merriam. Long-tailed Shrew

Ten from Great Glacier and two from Sergief Island (nos. 30542, 30543, 30545–30551, 31055). The series from Great Glacier is intermediate between *Sorex obscurus obscurus* and *S. o. longicauda*, but on the whole is nearer *longicauda*.

**Neosorex palustris navigator** Baird. Water Shrew

An adult male (no. 30568) was trapped near Telegraph Creek on June 22, in a bit of swampy land near the stream. Allen (1903, p. 567) has referred the water shrew of this region to *Neosorex palustris alaskanus* (Merriam), but our one specimen does not exhibit the characters ascribed to that race (cf. Merriam, 1900, p. 18). As compared with Californian examples of *navigator*, the Telegraph Creek specimen is exactly similar in general size and in skull characters, but is of slightly more grayish coloration.

I have seen one specimen of *Neosorex* from the coast of southeastern Alaska (in the collection of E. P. Walker), taken at Rudyard Bay, about one hundred miles south of the Stikine River, and this animal does exhibit the cranial peculiarities ascribed to *alaskanus*. It seems likely that the latter is confined to the coastal region.

**Microsorex eximius** (Osgood). Osgood Shrew

A single *Microsorex* (no. 30560) was trapped at the east end of Sawmill Lake, near Telegraph Creek, on June 16. The skull was crushed, debarring definite specific identification, but the specimen has been provisionally referred to the species *Microsorex eximius* by Dr. Jackson.

**Ursus, sp.?** Grizzly Bear

Grizzlies are still numerous in the Stikine region. We ourselves saw fresh sign at many points, though no animal was encountered. The most obvious indication of their presence was, of course, footprints, but other evidence was frequently found, such as rotten logs ripped to pieces by the bears for the insect food they contained. At Dochda-on Creek an unoccupied cabin in the woods was entered by a bear several times during the two weeks we spent at that place, and more or less damage done. At this point we saw grizzly tracks in the snow at timber line, about 4000 feet altitude.

At Hyland's store, Telegraph Creek, we examined ten grizzly skins, killed the previous fall, all from about the same place, on the Klappan River (a tributary of the Stikine) about 100 miles east of Telegraph Creek. Of these we purchased a skin with the skull of an old male (no. 31015) and a skin alone of a smaller animal, apparently a female (no. 31016). These specimens, both skins and skull, answer fairly well to the description of *Ursus stikeenensis* given by Merriam (1914, p. 178; 1918, p. 88).

There are no less than seven species of big bears accredited to this general region by Merriam (1918). Whether or not I have ascribed our specimens to the correct form, I think there is no doubt that all the skins in the above mentioned series belonged to one species, for there was really remarkable uniformity in color and markings in the lot. Subsequently the skin of another bear was examined, a huge male killed on Clearwater Creek, and it again was of exactly the same type. The noticeable color features are the general dark coloration, the yellowish or grayish grizzling on the shoulders and along the back, and the black feet, legs, and lower parts. The tanned skin of the male specimen, an animal that, from the appearance of the skull was evidently past maturity, measures from tip of nose to base of tail approximately 1680 millimeters; the one from Clearwater Creek, above mentioned, was very much larger. The claws are short for a grizzly, the longest claw on the male obtained measuring, with dividers, 55 millimeters. They appear to be much worn.

***Ursus americanus americanus* Pallas. Black Bear**

Black bears occur in some abundance throughout the whole of the region we traversed. They are frequently seen from the river boat in its travels up and down the Stikine. On June 5 one was seen not far from our camp at the Junction, rooting about under some rotten logs near the trail. Fresh tracks or other sign of the recent presence of black bears were seen practically everywhere we went except on Sergief Island.

Five black bear skulls were purchased from Mr. A. M. Vickery, of Telegraph Creek, the animals having been killed by him while he was patrolling the telegraph line to the southward of that place. One of these (no. 31017) is an old male, killed 122 miles south of Telegraph Creek, on May 25, 1919. The others are an old female and three small cubs (nos. 31018-31021) killed on June 17, 1919, 31 miles south of Telegraph Creek.

The two adult skulls from the Telegraph Creek region present certain evident points of difference from those of the black bear (*U. a. pugnax*) from the islands of southeastern Alaska. In the former the frontal region is relatively high and rounded, in the latter it is noticeably low and flat. In *pugnax* the whole skull is more angular in appearance. In *pugnax*, too, the teeth are large, as compared with those of bears from the interior, especially the last upper molar. This last character is one that persists in black bears from all the islands off the coast of southern Alaska and British Columbia. It is conspicuous in *pugnax* of the southern islands of the Alexander Archipelago, which has a large, squarely built, low browed skull. It is one of the characters of *carlottae*, from the Queen Charlotte Islands (cf. Osgood, 1901, p. 30), which has an elongate skull. It appears again in the black bear of Vancouver Island, which, judging from the several specimens at hand, is a smaller animal than *carlottae* or *pugnax*, with a rather high, rounded skull, and with the teeth of large size, especially the last upper molar.

There is very little material at hand from the mainland coast of southeastern Alaska. One rather young male from Bradfield Canal (a short distance south of the Stikine River) has the enlarged last upper molar of *pugnax*, and is apparently to be referred to that form. Thus it may be that *pugnax* occupies a narrow strip of coast on the mainland of southeastern Alaska as well as the islands, and that the type of black bear found in the Telegraph Creek region is confined to the territory east of the coastal range of mountains.

Of the available material, the Telegraph Creek skulls are most nearly of the type of those from the Kenai Peninsula and Yakutat Bay, Alaska. It may be that the name given to the black bear of the Kenai region by Allen (1910, p. 115), *Ursus americanus perniger*, should also be applied to the bears of the Stikine section, but at present it seems best to use the name *americanus* for the Stikine specimens. A revision of the group is necessary to determine, among other things, the applicability of the name *Ursus americanus* Pallas, and the characters pertaining to the form to which that name should be subspecifically restricted. In the present connection the main interest lies in the apparent occurrence of two different forms of the black bear in the Stikine region, *americanus* at the headwaters of the river, and *pugnax* in the coastal region near its mouth.

#### ***Canis occidentalis* Richardson. Timber Wolf**

Wolves, from all accounts, occur in some numbers throughout the interior of northern British Columbia, along the length of the Stikine Valley, and along the adjoining Alaskan coast and on the nearby islands. We saw none, nor any fresh sign, until we reached Sergief Island. There fresh wolf tracks were seen in the sand of the river bank, and on several occasions, when shooting out on the marsh, the reports of our guns started wolves howling in the forest nearby. On August 20 two of the animals were seen, and investigation showed that the place was the home of a wolf family, as it probably had been since the young were born, two or three months earlier. The two we saw were pups, not yet full grown, and they were probably awaiting the parent's return from a foraging expedition. Certain areas in the grass had been trampled flat, for beds, and a large flat rock nearby furnished an ideal lounging place. This rock rose above the marsh grass, and thus afforded an excellent observation station. Some cracks in the granite gave foothold to two scrubby spruce trees, arching over the rocky platform, and the rock below was covered with a deep layer of spruce needles, affording a dry, soft bed. This shelter had been occupied so much that the wolf smell clinging to it was apparent even to the duller olfactories of a human being. Broad trails led away through the grass over the marshes in various directions and into the impenetrable fastnesses of the spruce woods on the adjoining hillside. The trampled grass showed here and there bunches of feathers or a few crushed bones of ducks and geese; water fowl were evidently a staple food.

There were apparently three pups and one adult in this family. Two of the young were taken, and the old wolf then removed the survivor, evidently to some distance; no trace of the two was found anywhere about the island. The parent had been seen several times before the two young were caught.

Mr. W. E. Parrott, living upon Sergief Island, gave us the skin of an adult male wolf that he had shot on July 20. He was sitting at breakfast when his cat rushed into the house for protection from the wolf, which had chased the cat through the garden. Looking through the window, he saw the wolf, leisurely retreating toward the beach, and shot the animal. It was no new experience for the cat. Whenever his owner went to town a ladder was left leaning against the house, as a refuge in case of such pursuit, and apparently there was not infrequent occasion to use it.

The wolf thus obtained may have been the male parent of the family we encountered. In color this adult and the two pups are very much alike. The adult is rather dark, though not so black as some from this region. There is a good deal of black on the upperparts from the eyes to the tip of the tail, produced by black tippings to long hairs that are yellowish or reddish basally, the muzzle is reddish, the legs decidedly reddish, and the underparts a somewhat paler brown. It is not a gray appearing animal at all. The two pups are somewhat duller colored, with the black not so intense, and the reddish areas paler. In life, however, the young wolves looked quite dark.

There is at hand an adult male wolf from Prince of Wales Island, Alaska (southwestward from Sergief Island), that is almost entirely black. Another specimen from the interior, the Yukon region, is also black, so that evidently dark color alone can not be considered as distinguishing the wolves of either of these two regions. Two skulls of fully adult wolves from Iskut Summit, sixty miles southeast of Telegraph Creek, do not present any obvious points of difference from the above mentioned adult from Prince of Wales Island. The latter has been recorded by the present writer (Swarth, 1911, p. 136) as *Canis pambasileus* Elliot, in the belief that that name was applicable to a coastal subspecies. The Prince of Wales specimen presents characters of size and color such as are ascribed to *pambasileus* (Elliot, 1905, p. 79). Whether or not the name *pambasileus* may properly be used for a local race from the type locality, the Mt. McKinley region, it does not seem that any distinction can be made as between the wolf

of the coast of southeastern Alaska and the wolf of the adjoining interior. In the light of our limited material, and with the lack of a systematic revision of this group of mammals, it is safer to consider them as all one form, to which the name *Canis occidentalis* Richardson seems applicable.

The material obtained by us in the Stikine region consists of the following specimens: skulls and limb bones of two adults (nos. 31042, 31043) taken at Iskut Summit, sixty miles southeast of Telegraph Creek, the gift of an acquaintance at Telegraph Creek; an adult male (apparently not quite full grown), skin only (no. 31009), shot at Sergief Island, July 20, 1919; and two young females (about half-grown), skins and skulls (nos. 31010, 31011), taken at Sergief Island on August 24 and August 25, 1919.

***Mustela cicognani richardsoni* Bonaparte. Richardson Weasel**

Weasels undoubtedly occur throughout the region traversed, though we ourselves did not see one during the summer. At a trapper's cabin a few miles from Telegraph Creek a pile of desiccated weasel carcasses, his catch of the previous winter, yielded a series of nineteen skulls (nos. 31023-31041), with complete skeletons in most cases. These skulls, in comparison with a series from the coast of southeastern Alaska, exhibit the differences stated by Merriam (1896, pp. 11-13) to distinguish the two subspecies, *Mustela c. richardsoni* of the interior and *M. c. alascensis* of the coast. The Telegraph Creek skulls, as is claimed for *richardsoni*, are perceptibly narrower between the orbits and across the muzzle, and there is a slight difference in the shape of the zygomatic arches in the two lots.

Allen (1903, p. 563) has described *Putorius microtis* from Shesley, British Columbia, near the headwaters of the Stikine, but our series of skulls from Telegraph Creek are evidently all of one species, *Mustela c. richardsoni*.

***Mustela vison energumenos* (Bangs). British Columbia Mink**

One trapped at Doch-da-on Creek on July 19 (no. 31002), and a skeleton preserved that was picked up near Telegraph Creek (no. 31022). The species occurs, probably in fair abundance, throughout the whole Stikine region. The one skin obtained is notably dark colored as compared with specimens of *Mustela v. nesolestes* from certain islands of the Alexander Archipelago, and we were told that the mink

from the Stikine were all dark. The skull pertaining to this specimen has the small sized last upper molar that is supposed to distinguish *energumenos* from *nesolestes*, but in the skull from Telegraph Creek this tooth is as large as in most examples of the latter subspecies. There is at hand a mink from near the mouth of the Taku River and one from Wrangell, both of which are of the same dark color as our Stikine River specimen. Thus the specimens available suggest the existence of a dark colored mainland form extending toward the coast at least along the larger rivers, and reaching some of the islands lying nearest the mainland, and a lighter colored subspecies existing upon most of the islands of the Alexander Archipelago. There is not sufficient material available, however, to verify this surmise.

At any rate, the mink of the upper Stikine Valley is a relatively small form, and not the large *ingens* of the nearby Yukon drainage. At present it seems proper to use for this race the name *Mustela vison energumenos* (Bangs), originally applied to the mink of southern British Columbia. Our one specimen is very similar in appearance to an example of *energumenos* from the vicinity of Seattle.

### ***Phoca richardi richardi* (Gray). Harbor Seal**

Seals were observed as far up the Stikine River as Doch-da-on Creek, at times in considerable numbers. On May 21, as we began our trip up the river, they were seen in veritable herds over the first thirty miles. At one place there were at least a hundred in sight at once. Farther up stream they became less and less abundant. No specimens were obtained, and the identification here accorded the animals seen is purely inferential.

### ***Peromyscus maniculatus borealis* Mearns. Northern White-footed Mouse**

### ***Peromyscus maniculatus macrorhinus* (Rhoads). Rhoads White-footed Mouse**

One hundred and thirty-eight specimens of white-footed mice were preserved, as follows: The Junction, 24 (all adults); Telegraph Creek, 29 (24 adults and 5 young); Glenora, 27 (23 adults and 4 young); Doch-da-on Creek, 27 (15 adults and 12 young); Flood Glacier, 28 (10 adults and 18 young); Great Glacier, 2 adults; Sergief Island, 1 young. (Museum numbers 30569-30705, 31050.)

A series of white-footed mice collected at and near Telegraph Creek in 1902 has been reported upon by Allen (1903, p. 540) under the name *Peromyscus arcticus* (Mearns) (= *Peromyscus maniculatus borealis* Mearns [1911, p. 102]). What is undoubtedly the same series of specimens is listed by Osgood (1909a, p. 49) under *Peromyscus maniculatus arcticus* (Mearns). Therefore, though this museum possesses no examples of *Peromyscus maniculatus borealis* other than our series from the Telegraph Creek region, I feel justified, on the grounds above mentioned, in assuming this series to be representative of the subspecies *borealis*. The chief interest attaching to the Telegraph Creek form in the present connection lies in its relationship to the subspecies *Peromyscus m. macrorhinus*, from the region adjacent to the mouth of the Stikine River. Of *macrorhinus* this museum possesses an abundant representation from various points in southeastern Alaska.

Before proceeding with a discussion of the specimens we collected, certain features of the problem should be stated, in the interest of a clear understanding of conditions. Osgood (1909a) in his comments upon *arcticus* (= *borealis*) and *macrorhinus* makes no direct comparison between the two; at that time there were no specimens extant to show that these forms came together at any point. From his "key" and descriptions, however, certain contrasting characters of these subspecies may be summarized as follows:

*Peromyscus m. macrorhinus*. General size larger; hind foot, 24 to 25 mm. Tail longer than head and body; usually more than 90, often more than 100 mm. Coloration darker.

*Peromyscus m. borealis*. General size smaller; hind foot, 19 to 21 mm. Tail about equal to or shorter than head and body; usually less than 90 mm. Coloration paler.

On the Alaskan coast just north of the habitat of *macrorhinus* is the subspecies *hylaesus*. Between *hylaesus* and *borealis*, in the region north of Telegraph Creek, is the subspecies *algidus*, "the interior representative of the dark coast form *hylaesus*" (Osgood, 1909a, p. 56). According to Osgood (*loc. cit.*), *algidus* and *borealis* occur together in places within the general range of the former, and maintain their distinctness. *Algidus*, compared with *borealis*, is a long-tailed form; it differs from the latter in this respect just as *macrorhinus* does. Allen (1903, p. 544) records as *Peromyscus oreas* a single mouse taken in the Cheonnee Mountains (near Telegraph Creek), where *borealis* also was secured. This same specimen, presumably, is recorded by Osgood (*loc. cit.*) as *algidus*. The Cheonnee Mountains are a short distance



southeast of Telegraph Creek; if *algidus* occurs in that range it should be at Telegraph Creek also.

We obtained several long-tailed specimens of *Peromyscus* at and near Telegraph Creek, and supposed that they were examples of *algidus*. Study of the series as a whole, however, inclines me to another explanation of the variation, that seems more satisfactory, namely, that there is continuous distribution of *Peromyscus* along the Stikine Valley, from the habitat of *borealis* in the interior to that of *macrorhinus* on the coast, that there is intergradation between these two subspecies in the Stikine Valley, that Telegraph Creek is about the easternmost point to which intergrades with *macrorhinus* extend, and that the variants obtained by us at that point are all the results of intergradation.

The long-tailed individuals from the Telegraph Creek region, aside from this peculiarity, are not notably different in color or otherwise from the general run of specimens obtained there. At any rate, they could not be grouped together as presenting an aggregation of characters justifying their separation as a distinct subspecies. Neither were they obtained under circumstances that would tend to establish the belief that two different races were concerned.

The *Peromyscus* taken at the Junction are lighter colored than *macrorhinus* of the coast, and they are smaller and shorter tailed. This station is some five miles north of the Stikine River; presumably these mice are more nearly typical of *borealis* than any others we obtained. In this series there is one aberrant individual with an exceedingly long tail; otherwise there is great uniformity in the lot. At the town of Telegraph Creek we obtained more long-tailed mice, and noted a slight increase in general size, as compared with the series from the Junction. Descending the Stikine River from Telegraph Creek, the *Peromyscus* collected at our various stations were progressively larger and darker colored as the coast was approached.

The accompanying diagrams (figs. R, S, T) show variation in hind foot, length of tail vertebrae, and ratio of tail vertebrae to total length, in the white-footed mice taken at our various collecting stations in the Stikine region, as compared with *macrorhinus* of the Alaskan coast. Color and general size vary in about the same way as the characters illustrated. Barring the series from the Junction, which are probably close to true *borealis*, the Stikine River *Peromyscus* are typical of neither *borealis* nor *macrorhinus*. They form a series of intergrades between the two. It is not possible to draw a hard and fast line as a

boundary, both on account of the gradual change in the entire *Peromyscus* population of the intermediate territory and because of individual variation, which brings typical examples of each far within the margin on either side of the debatable strip. Allowing for such variation, however, it seems proper, though an arbitrary division, to consider as *borealis* the mice from the upper Stikine, as far down as Glenora, *macrorhinus* extending up stream as far as Doch-da-on Creek.

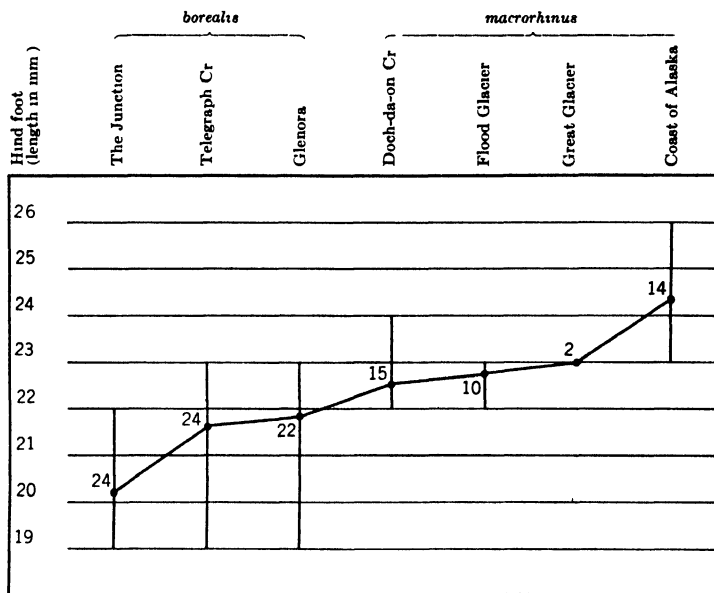


Fig. R. Diagram showing individual and geographic variation in length of hind foot of adult white-footed mice (both sexes). Figures at left of the vertical lines indicate numbers of specimens measured; length of lines shows range of individual variation; points connected by lines mark positions of averages.

White-footed mice were found in abundance about human habitations. Usually they were uncommon elsewhere. At the Junction the trapping was done along a stream and in poplar woods, miles from houses, and white-footed mice, while perhaps more abundant than any other small mammal, were not at all numerous. At Telegraph Creek most of our specimens were caught in the house in which we were staying; a few were taken in our several trap lines a mile or more from town. The rows of empty houses at Glenora formed a haven for white-footed mice, and they swarmed there in almost incredible numbers. At Doch-da-on Creek white-footed mice were abundant in the

weed-grown bottom lands, much more so than we found them to be on any other wild land. At Flood Glacier we had difficulty in getting specimens, and at Great Glacier, though some small mammals were more abundant than we found them elsewhere, only two white-footed mice were obtained. At Sergief Island they were extremely scarce; only one specimen was taken.

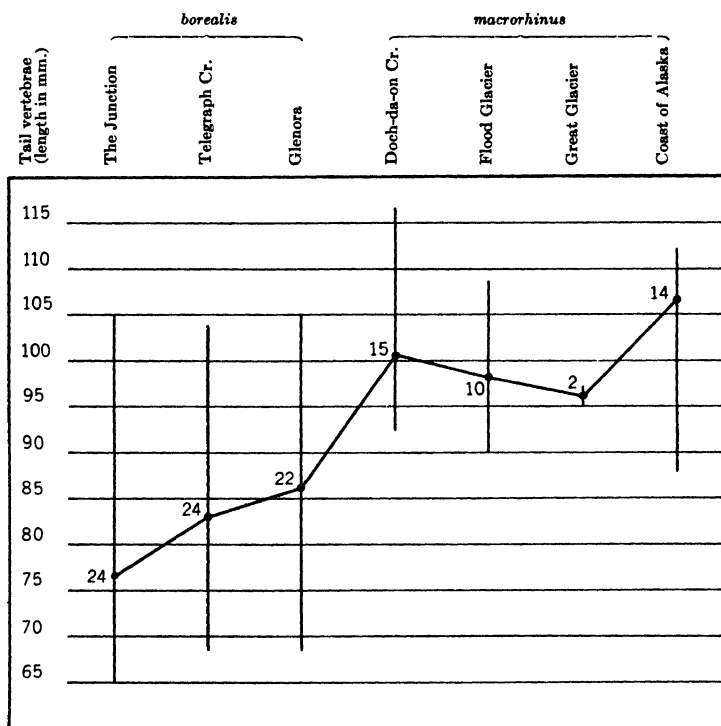


Fig. 8. Diagram showing individual and geographic variation in length of tail of adult white-footed mice (both sexes). Figures at left of the vertical lines indicate numbers of specimens measured; length of lines shows range of individual variation; points connected by lines mark positions of averages.

At the Junction, May 25 to June 6, all *Peromyscus* taken were adult. Most of the females contained embryos, four or five in number; one or two were nursing young. At Telegraph Creek the first week in June young mice began to get into the traps. From the third week in June, on during the rest of the summer, the dark coated juvenals formed the greater part of the catch. At Glenora two *Peromyscus* were caught which had their cheeks filled with a mass of small seeds. The cheeks were distended to the utmost, just as is so often seen in

chipmunks and ground squirrels. This, I believe, is an unusual action for a *Peromyscus*. At the same place an adult female was trapped that had lost one hind leg at the knee and all of the tail. These mutilations were evidently of long standing and the animal was in good condition otherwise. It may be doubted, however, whether it could have survived them in other surroundings; the old cabins here occupied by the mice probably afforded exceptional shelter from many dangers.

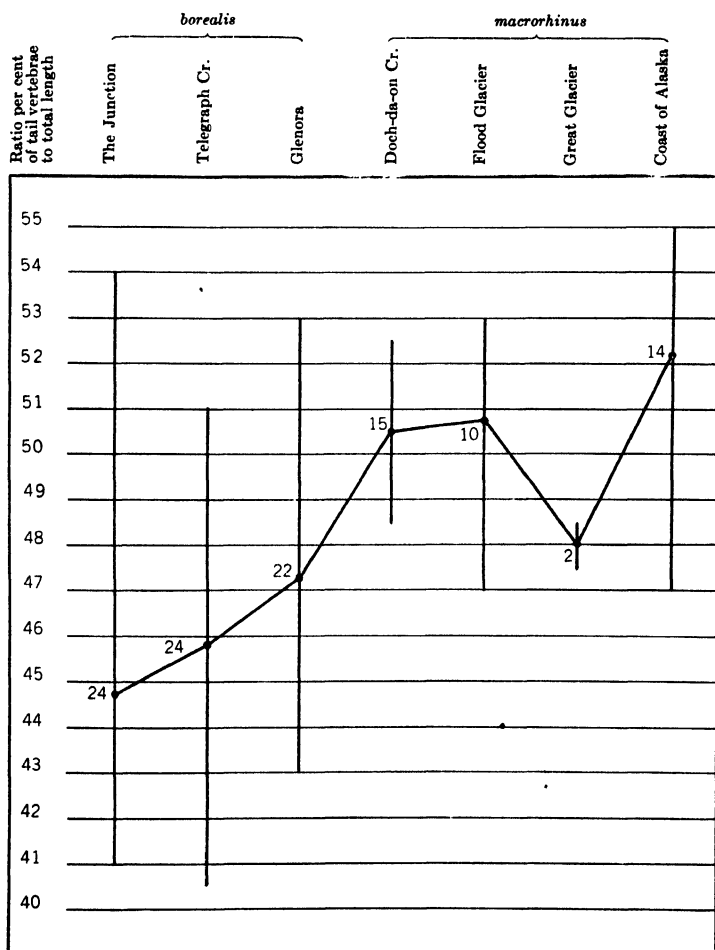


Fig. T. Diagram showing individual and geographic variation in ratio of length of tail vertebrae to total length in adult white-footed mice (both sexes). Figures at left of the vertical lines indicate numbers of specimens measured, length of lines shows range of individual variation; points connected by lines mark positions of averages.

***Neotoma cinerea saxamans* Osgood.** Northern Bushy-tailed Wood Rat

Fourteen specimens collected at the following points in the upper Stikine Valley: Telegraph Creek, six adults, two young; Glenora, one adult, four young; mountain above Doch-da-on Creek, one adult. (Museum nos. 30706-30719.) At Telegraph Creek specimens were taken in the talus at the base of certain rocky cliffs that rise back of the town. The rats were not numerous, and after one or two had been caught at a place the traps usually remained undisturbed. The old houses of the abandoned town of Glenora afforded shelter to the wood rats, but apparently not more than one or two families occupied any one cabin. From several of the cabins the rats had well worn trails leading into the surrounding thickets. There they cut quantities of green vegetation, some to be carried into the houses and eaten at once, some apparently to be dried for later use. Most of the old cabins had the doors and windows boarded up, and in the gloom of the interior the rats and mice were active all day.

The cabins and warehouses with their miscellaneous contents, long abandoned, formed a veritable wood rats' paradise, and they gave their imagination full swing in the lines of nest building and the accumulation of useless objects, for which their tribe is famous. In one place a storeroom full of snowshoes had been entered, and of the contents there was little but the wooden frames left. The leather thongs were hanging in shreds. In an old barn, round masses of baling wire had been filled out with horse manure and grass to form extraordinary globular nests.

The one specimen of *Neotoma* from the vicinity of Doch-da-on Creek was taken on the mountain side at an elevation of about 2000 feet. This was the farthest down stream that we found the species, but I was told by a trapper that he had occasionally seen wood rats near the mouth of the Iskut River, which empties into the Stikine a little above the British Columbia-Alaska boundary line.

A young one taken at Telegraph Creek on June 9 was about one-third grown. Others were trapped at Glenora three weeks later, of about the same size. Three adult females caught at Telegraph Creek on June 9 contained embryos; two had three each, one had four.

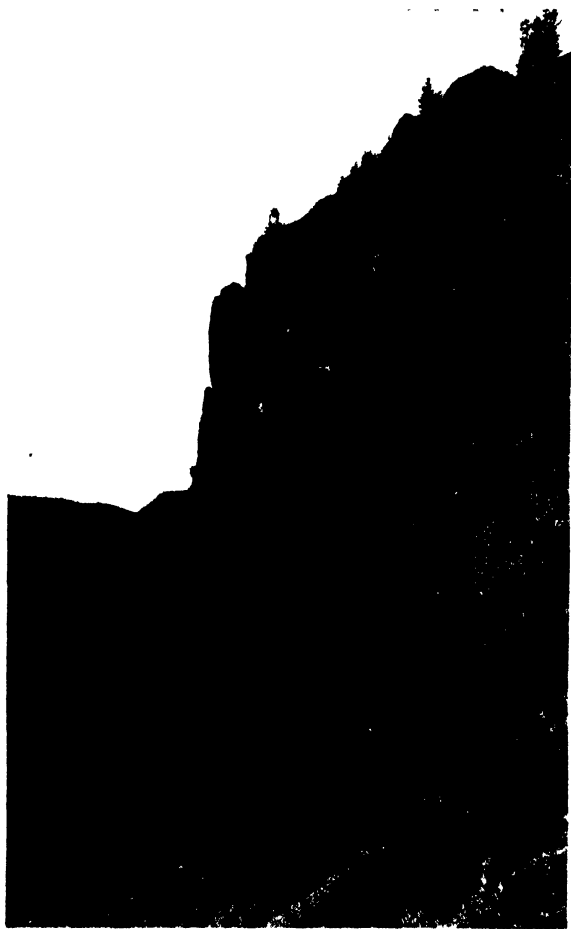


Fig. U. Basaltic cliff at Telegraph Creek. The talus beneath is a favorite habitat of the bushy-tailed woodrat. At the upper edge of the loose rocks in particular, many sticks and other rubbish accumulated by these rats were to be seen between the larger boulders. Photograph taken June 12, 1919.

**Synaptomys borealis wrangeli** Merriam. Wrangell Lemming Mouse

Found at but one place on the river, at Great Glacier. Three specimens obtained (nos. 30752-30754), all males, taken on August 10, 13, and 14, respectively. Just one, the largest and the only one that is fully mature, shows the gray patches over the hip glands. All three were trapped in alder thickets, in places frequented by *Evotomys*.

There have been available for comparison three specimens of lemming mice (in the E. P. Walker collection), from Wrangell, Alaska, the type locality of *Synaptomys wrangeli*, ten from mainland points in southeastern Alaska, ranging from Boca de Quadra to Port Snettisham, and nine from the Prince William Sound region, Alaska. I also received, as a loan from the United States Biological Survey, six typical specimens of *Synaptomys borealis dalli*, three from points near the base of the Alaska Peninsula, two from the Kuskokwim drainage, and one from the Yukon.

As far as I can see, the specimens from the coast of southeastern Alaska, island and mainland, are all alike. They are all *wrangeli*. Furthermore, the differences between *wrangeli* and *dalli* are slight, and as these differences in the series here assembled are bridged by individual variation and to some extent by geographic variation, I consider the two forms as subspecies of one species, *Synaptomys borealis*. (For the use of this name, see Preble, 1908, pp. 183-186. See also Hollister, 1912, p. 19.)

The skull of *dalli*, compared with *wrangeli*, is somewhat larger, and rather more angular, and more heavily built. Otherwise, I can see no differences in the two lots. Some of those from the Prince William Sound region incline toward *dalli* in their larger size, as compared with more southern specimens, indicating, perhaps, intergradation between *wrangeli* and *dalli* at what is probably the northern limit of the form *wrangeli*. Externally, four specimens of *dalli* are appreciably more reddish than any in the *wrangeli* series. The two remaining *dalli* are of the same coloration as the mode of *wrangeli*.

Thus, instead of *wrangeli* being an insular species, confined to Wrangell Island, my conception of it is as being a rather wide ranging form, and a coastal subspecies, contrasted with *dalli* of the interior. Its range is the coast of southeastern Alaska, from Prince William Sound south at least to Boca de Quadra. It has been taken upon two islands, Hinchinbrook Island, Prince William Sound, and Wrangell Island, both but slightly separated from the mainland.

Another species, *Synaptomys andersoni*, has been described by Allen (1903, p. 554), based upon a single specimen from Level Mountain, near the headwaters of the Stikine River. In all likelihood, therefore, mice of this genus occur throughout the entire length of the Stikine Valley. At present, however, with the few specimens extant in collections, it is not possible to form an opinion as to whether or not there are two species or subspecies in existence, at the head of the river, and toward its mouth, respectively.

***Evotomys dawsoni dawsoni* Merriam. Dawson Red-backed Mouse**

An adult female (no. 30720) was taken at the Junction, June 4, trapped during the day on a dry, poplar-covered hillside. It is apparently a typical example of *Evotomys dawsoni dawsoni*. The next obtained (no. 30721) was caught at Doch-da-on Creek, July 17, in a tangle of alders, grass, and nettles bordering a slough. This specimen is a male, not fully mature but evidently referable to *dawsoni*. Somewhere in the section of the river between Doch-da-on Creek and Flood Glacier lies the dividing line between *dawsoni* and *wrangeli*. It would be of interest to find if the two occurred together at any point.

***Evotomys wrangeli* Bailey. Wrangell Red-backed Mouse**

Thirty specimens taken (nos. 30722–30751), three at Flood Glacier, twenty-three at Great Glacier, and four at Sergief Island. Of this series there is one old male (no. 30735, Great Glacier), with conspicuous gray patches over the hip glands, and showing rooted molars with deeply worn surfaces. There are eleven more that may be termed adult, as being in the adult pelage (though none of these has the gray flank patches more than faintly indicated). The remainder are young at various stages of growth.

The red-backed mice from these three stations are all *E. wrangeli*, indistinguishable from specimens at hand from Wrangell Island. The range of that species is thus carried far inland up the Stikine Valley, very close to the habitat of *dawsoni*, if in fact the two do not meet. The four specimens from the uppermost station, Flood Glacier, show no appreciable departure from the mode of *wrangeli*; there is no indication here of intergradation toward the nearly adjacent *dawsoni*.

The two species, however, resemble each other so closely in form, and in some pelages in color also, that *wrangeli* would seem to be a coastal offshoot of *dawsoni*, bearing somewhat the same relation to that



species as *Microtus admiraltiae*, of Admiralty Island, does to *M. drummondi* of the adjacent mainland. The two *Microtus*, however, are less widely separated than the *Evotomys* have become. Further, it may be assumed that *Evotomys phaeus*, of the Alaskan mainland south of the habitat of *wrangeli*, is of a different line of descent, it differs so markedly from both *dawsoni* and *wrangeli* in its combination of large size, pale coloration, and long tail. Much remains to be learned regarding the distribution and relationships of the red-backed mice of the northwest.

TABLE I

Measurements in millimeters (average, minimum and maximum) of adult *Evotomys wrangeli* from Wrangell, Alaska; measurements taken by Ernest P. Walker

	Total length	Tail vertebrae	Hind foot	Ear
10 adult males.....	141 (130-159)	35.7 (31-42)	18.2 (18-19)	11.8 (10-13)
10 adult females.....	131.4 (127-152)	32.4 (28-40)	17.9 (17-18)	11.9 (10-13)

TABLE II

Measurements in millimeters of adult *Evotomys* from the Stikine River

<i>Evotomys wrangeli</i>				Tail vertebrae	Hind foot	Ear
			Length			
30724	♂	Flood Glacier	Aug. 4, 1919	135	34	19
30735	♂	Great Glacier	Aug. 13, 1919	145	39	20
30751	♂	Sergief Island	Aug. 24, 1919	135	34	20
30726	♀	Great Glacier	Aug. 11, 1919	140	33	20
30728	♀	Great Glacier	Aug. 12, 1919	147	34	19
30732	♀	Great Glacier	Aug. 13, 1919	125	33	20
30749	♀	Sergief Island	Aug. 22, 1919	148	36	19
<i>Evotomys dawsoni dawsoni</i>						
30720	♀	4 mi. N. Telegraph Creek	June 14, 1919	120	29	17
30721	♂	Doch-da-on Creek	July 17, 1919	129	28	18

### ***Microtus drummondi* (Audubon and Bachman).**

#### **Drummond Meadow Mouse**

Fifty-five specimens taken (nos. 30755-30809), from the following points: Sawmill Lake, near Telegraph Creek, 16; Glenora, 20; Doch-da-on Creek, 18; Sergief Island, 1.

Around Telegraph Creek we found this species at but one place, in the immediate vicinity of Sawmill Lake. Some parts of the lake shore were grown with tall grass, partly flooded, and strewn with logs and other drift. Here the Drummond meadow mice had their homes; their runways traversed the moss-grown logs, and, in the intervals between, they evidently traveled through very deep water when necessary.

Allen (1903, p. 550) comments upon the capture of but a single specimen of *M. drummondi* at Telegraph Creek, compared with an abundance of *M. mordax*, as indicative of the two species having different centers of abundance, but from our own experience there seems to be demonstrated merely a preference for different sorts of surroundings. *Microtus mordax*, about Telegraph Creek, was mainly caught along stream sides, the kind of habitat it is known to frequent in other parts of its range, and none was taken in any of the semi-aquatic runways where *M. drummondi* was obtained.

At Glenora the two species occurred in exactly the same places, runways used commonly by both traversing the weed-grown meadows about the old houses. At Doch-da-on Creek also they were found together in the bottom lands.

We took no Drummond meadow mice at either Flood Glacier or Great Glacier, but the capture of a single specimen at Sergief Island may be taken as indicative of the occurrence of the species over the entire length of the river. There are probably times when *drummondi* is abundant at Sergief Island, but our visit there was during a period of scarcity.

Half-grown young were taken at Telegraph Creek the middle of June, and a little later young not more than two-thirds the bulk of adults were breeding. Embryos in gravid females ranged from four to ten in number.

### ***Microtus mordax mordax* (Merriam).** Cantankerous Meadow Mouse

Found at every collecting station except Sergief Island, but not equally numerous at all places. One hundred and one specimens taken (nos. 30810-30909, 31051), from the following points: The Junction, 12; Telegraph Creek, 16; Glenora, 38; Doch-da-on Creek, 21; Flood Glacier, 12; Great Glacier, 2. At the Junction, May 25 to June 6, specimens came in slowly. There was a little meadow at that point that showed signs of having been populated by meadow mice during the winter months, but the animals had since moved into the nearby woods. Those we obtained were taken along the streams or in wet places among the trees. They were apparently rather solitary in their habits and there were no well defined runways in use. At Glenora meadow mice were extremely abundant. The open meadow land was not frequented to any extent, but there were extensive clearings, since grown up with fireweed, that were intersected in every direction with

much-traveled runways. The shelter afforded by rail fences and the sides of the crumbling houses was also taken advantage of, and traps placed in such situations yielded mice night after night. A great many more were caught at that station than the thirty-eight that were preserved.

At Doch-da-on Creek, this meadow mouse was not especially abundant. Most that were caught were taken in weed-grown bottom lands. At Flood Glacier, well defined runways, with many little piles of freshly cut green stuff, gave an appearance of an abundance of meadow mice, but despite the plentiful sign, specimens were taken but slowly. Apparently one full-grown *Microtus* can establish and operate an elaborate system of runways. One weed-grown area some fifty feet square, intersected with well used paths in which were found fifteen or twenty little piles of freshly cut green weed stems, yielded just one adult meadow mouse. At Great Glacier but two specimens were trapped.

The occurrence of a meadow mouse of the *longicaudus* group over the entire length of the Stikine River is of interest as bearing upon the relationship of *Microtus mordax* of the interior and *M. macrurus* of the coast. The two forms are closely related, and though heretofore recognized as distinct species, the differences between them are comparable to what is found among subspecies of some one species in other sections of the genus. The main differences between the two are of coloration and of length of tail. There are skull differences also but not trenchant ones. *Macrurus*, like other coastal species, is of dark brownish coloration, quite reddish-brown dorsally; *mordax* is distinctly gray. *Macrurus* has a longer tail than *mordax*, longer in actual measurement and longer in relation to total length. Both *macrurus* and *mordax* in the northern parts of their respective ranges (southeastern Alaska and northern British Columbia) are somewhat smaller than they are at their southern limits.

We obtained long-tailed meadow mice at various points on the Stikine River down as far as Great Glacier, and I have at hand several additional specimens (from the collection of E. P. Walker) taken at Clearwater Creek, just below the British Columbia-Alaska boundary line. There are also available specimens from Wrangell and Mitkof islands (near the mouth of the Stikine), and from various points on the mainland short distances north and south of the mouth of the river. *Macrurus* is abundantly represented in the collection of this Museum from various points in the Alexander Archipelago.

*Macrurus*, as represented by specimens from the more western islands of the Alexander Archipelago, is a very different looking animal from *mordax* of the interior. The brown coloration of the one, and the gray of the other, correlated with the differences in size and length of tail, render the two series absolutely unlike. Meadow mice from Mitkof and Wrangell islands, however, are, in color, about midway between the extremes indicated, and the few specimens at hand from the lower Stikine tend still further to bridge the gap. As regards color, it is possible to arrange specimens with regard to geographical position, so as to produce a graded series of changes from one extreme to the other, with no abrupt break at any point. The same is true of general size, and of skull characters. The accompanying diagram (fig. V)

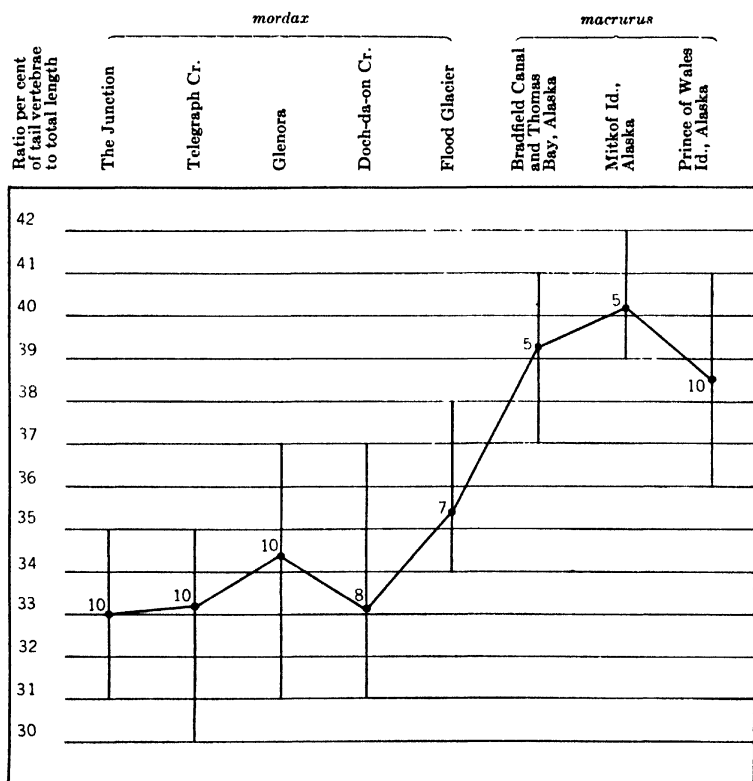


Fig. V. Diagram showing individual and geographic variation in ratio of length of tail vertebrae to total length in adult long-tailed meadow mice (both sexes). Figures at left of the vertical lines indicate numbers of specimens measured; length of lines shows range of individual variation; points connected by lines mark positions of averages.

shows the manner in which ratio of length of tail to total length acts between one extreme and the other. There is a gradual lengthening of tail as the lower river is approached. On these grounds I believe that *macrurus* should be treated as a subspecies of *Microtus mordax*. *Microtus mordax mordax* may be regarded as occurring along the Stikine River at least as far down as a point (Clearwater Creek) some twenty miles from the mouth of the river.

*Microtus vellerosus* was described by Allen (1899, p. 7) from the Liard River, and specimens from Telegraph Creek were referred by the same writer (1903, p. 548) to that form, regarded as a subspecies, *Microtus mordax vellerosus*. Bailey, in his revision of the genus *Microtus* (1900, p. 48, footnote), denies recognition to this race, regarding it as inseparable from typical *Microtus mordax mordax*. Comparing our Telegraph Creek specimens with series of *mordax* from northern California, I am unable to distinguish between them, consequently I follow Bailey in the use of the name *mordax* for the northern animal.

TABLE III

Measurements in millimeters (average, minimum and maximum) of adult *Microtus* from the Stikine region and from southeastern Alaska

<i>Microtus mordax mordax</i>	Total length	Tail vertebrae	Hind foot
10 adults, The Junction, Stikine River	170.6 (155.0-180.0)	55.3 (50.0-62.0)	20.9 (20.0-22.0)
10 adults, Telegraph Creek, Stikine River	182.5 (170.0-197.0)	60.8 (51.0-70.0)	21.0 (20.0-22.0)
10 adults, Glenora, Stikine River	192.2 (170.0-206.0)	66.7 (52.0-76.0)	21.4 (21.0-22.0)
8 adults, Doch-da-on Creek, Stikine River	184.1 (170.0-200.0)	62.9 (55.0-70.0)	21.0 (20.0-22.0)
7 adults, Flood Glacier, Stikine River	186.4 (180.0-200.0)	66.1 (62.0-70.0)	22.4 (22.0-23.0)
<i>Microtus mordax macrurus</i>			
5 adults, Mitkof Island, s.e. Alaska	174.2 (164.0-183.0)	70.4 (68.0-72.0)	21.8 (21.0-22.0)
10 adults, Prince of Wales Island, s. e. Alaska	189.3 (172.0-207.0)	73.3 (63.0-80.0)	21.1 (20.0-22.0)

***Ondatra zibethica spatulata* (Osgood). Northwestern Muskrat**

Taken at but one point, on Sergief Island. Six specimens were taken (nos. 30996-31001), on September 3, 4 and 5, of which three are adult and three young. Of one the skin was subsequently lost, leaving the specimen represented by a skull only. The muskrats frequented a series of little ponds just above the reach of the tides, where the grasses of the salt marsh gave place to clusters of reeds and thickets of alder and willow. These ponds were connected by well trodden trails through the grass, like large *Microtus* runways, paths that could be

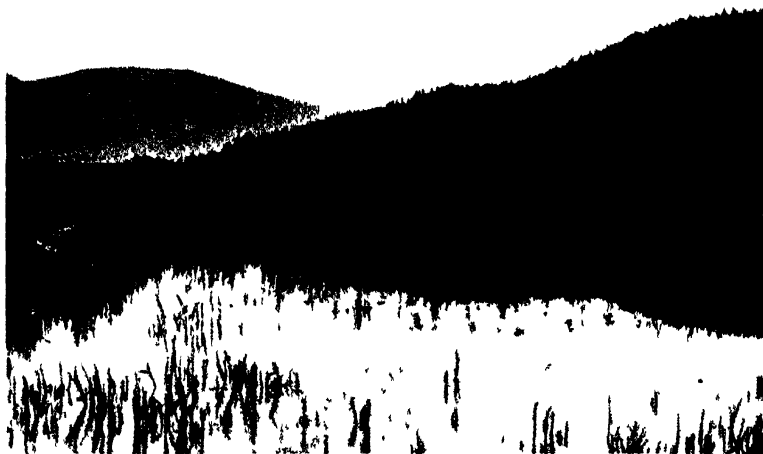


Fig. W. Marsh at western end of Sergief Island, Alaska. The rocky backbone of the island, densely covered with spruce, rises abruptly from the surrounding swamps. At the base of this slope is a bordering fringe of bushes, mostly alder, red-berry elder and willow, with, underneath, tangles of salmon-berry and devil's club. The marshes farthest inland, as here shown, are mostly of fresh water, with growths of tules and other fresh-water plants. This pond and others nearby were frequented by muskrats. The surface of this pond was in part covered with floating tules that had been recently cut by these mammals. Birds seen in such surroundings were green-winged teal, pintail, mallard, pectoral sandpiper, and Wilson snipe. Black swifts were seen almost daily soaring over this marsh. Photograph taken September 5, 1919.

traced in the muddy bottom of shallow water and even across the deeper ponds, for the line of travel parted the floating moss and other aquatic vegetation and left just as distinctly marked a highway in the water as elsewhere. All along these trails there were signs of muskrat activities, masses of cut reeds floating in the ponds, and piles of coarse grass and other vegetation in the drier places. There were

no "houses" to be seen anywhere. Apparently the animals were living in the shallow banks bordering some of the ponds, but this must have been farther back in the alder thickets than we penetrated, for we found no occupied burrows.

Muskrats presumably occur the length of the Stikine River, but if so they are scarce, or else, perhaps, in widely scattered colonies that are easily overlooked. Fresh sign was found about a beaver pond at Flood Glacier, but evidently of but a few individuals. We were told of the occurrence of muskrats at Doch-da-on Creek, but we, ourselves, saw no evidence of their presence.

The specimens obtained present such marked peculiarities of appearance as may very well be indicative of an undescribed race from the coast of southeastern Alaska, but at present it does not seem advisable to affix a name to this isolated series. In color they are dark dorsally, and extremely gray elsewhere. *Spatulata*, as represented in this Museum by comparable specimens from various parts of its range to the northward of the Stikine, is decidedly reddish. Our Sergief Island specimens are closely similar to fall examples of *osoyoosensis* from the Puget Sound region. Some of the latter have an indication of cinnamon on the underparts and sides, which is seen in none of the Sergief Island specimens, but there are certain skins from the neighborhood of Seattle that are exactly like them in color. *Osoyoosensis*, however, is a large species, and the specimens in question are of small size, agreeing with *spatulata* in this respect. Thus the Sergief Island muskrats are like *osoyoosensis* in color, like *spatulata* in size. The skull is of the *spatulata* type, being relatively broad, with wide spreading zygomata.

There are five muskrats at hand (Mus. Vert. Zool., nos. 8353-8357) from Revillagigedo Island, Alaska, which lies south of the Stikine River, hence nearer the range of typical *osoyoosensis*. These specimens, according to Hollister (1911, p. 23), "while typical of *spatulatus* in size and color, show a slight approach toward *osoyoosensis* in the shape of the audital bullae and in the high, rounded jugals." It is obviously necessary that specimens be taken from various points along the coast between the known habitats of *spatulata* and *osoyoosensis* before the peculiarities of the series at hand from Revillagigedo and Sergief islands can be explained. In the meantime, while those from the latter point are not particularly like *spatulata*, I prefer to list them by that name, as the race they most nearly resemble, rather than apply a new one, based upon characters the meaning of which is not understood.

TABLE IV

Measurements in millimeters of adult *Ondatra*

		Total length	Tail vertebrae	Hind foot
30996	♀ ad. Sergief Id., Alaska	502	235	76
30998	♂ ad. Sergief Id., Alaska	520	225	74
31006	♂ ad. Sergief Id., Alaska	590	246	77
Average of 4 adults of <i>Ondatra z. spatulata</i> , northern British Columbia and Alberta <sup>1</sup>		530	232	74.5
Average of 10 adults of <i>Ondatra z. osoyoosensis</i> , from Oroville, Wash. <sup>2</sup>		589	271	83

<sup>1</sup>Hollister, 1911, p. 22<sup>2</sup>Hollister, 1911, p. 25**Mus musculus musculus** Linnaeus. House Mouse

One specimen preserved (no. 30910), an immature female caught at Sawmill Lake, June 12; several were trapped in a warehouse at Telegraph Creek. Allen (1903, p. 540) has recorded the occurrence of *Mus musculus* at Telegraph Creek in 1902, and it has probably been established there since a much earlier date, but from our experience it would seem not to be increasing in numbers or extending its range to any extent. It is an interesting fact that we did not obtain any at Glenora. House mice must have been there when the town was occupied by people. Apparently upon the withdrawal of the human population, the introduced *Mus musculus* was unable to compete successfully with the native *Peromyscus*, even under as favorable conditions as prevailed in the wooden houses of the abandoned city.

**Zapus saltator** Allen. Stikine Jumping Mouse

Found only near Telegraph Creek and at Glenora. The former is the type locality of this species (see Allen, 1899, p. 3) and a special effort was made there to get a series but the mice were not so numerous as at Glenora. Altogether, thirty-seven Stikine jumping mice were preserved (nos. 30911-30945, 31048, 31049), as follows: from The Junction, 1; Telegraph Creek, 7; Glenora, 29. All that were taken were adults. No young ones were seen and no gravid females were collected until June 30. After that date embryos, three to five in number, were found in most of the females taken.

At Telegraph Creek specimens were caught in traps set about the edge of Sawmill Lake, mostly in thickets or under logs. At Glenora the jumping mice were found using *Microtus* runways extensively,



in the tall grass and fireweed. They were evidently more or less active during the day, at least in the early morning. There is considerable color variation in the series we collected, about one-fourth of the specimens being notably grayish as compared with the rest, and with very little brown on the back or ochraceous on the sides.

*Zapus saltator* has been taken at the mouth of the Skeena River (Preble, 1899, p. 32), and at the mouth of the Taku River (Swarth, 1911, p. 135). It would seem therefore that it might also range the entire length of the Stikine River, and I believe it to be very possible that it does so, despite our failure to obtain specimens along the lower part of that stream.

### **Erethizon epixanthum nigrescens** Allen. Dusky Porcupine

Porcupines occur throughout the whole of the region we traversed, but they are apparently not abundant. We saw very few. On June 12 one was taken a few miles west of Telegraph Creek. On July 11 one was seen on the mountain side above Doch-da-on Creek, and on July 17 one entered our camp at the same locality. These were all that were encountered during the summer. The one obtained (no. 31001), a male, is not much more than half the bulk of an ordinary adult porcupine, but aside from its small size there is little about the animal to suggest immaturity. It must have been born the preceding year at least. It was badly infested with tapeworms, the abdominal cavity containing packed masses of the parasite in almost incredible amount, and this condition might, perhaps, explain the poor physical development of the host. The general coloration of this animal is pale yellow, the long overhairs being extensively tipped with this color and the quills being mostly yellowish. The basal portion of the body hairs is dull brownish, as is also the entire face. The two other porcupines that were seen, apparently normal adults, were extremely dark colored.

### **Marmota caligata caligata** (Eschscholtz). Northern Hoary Marmot

Apparently a timber-line species in the upper Stikine region, and descending to sea level at the coast. Whether or not it also occurs at high altitudes in the coastal region I do not know. We saw none in the immediate vicinity of Telegraph Creek, though the species doubtless occurs in the surrounding mountains. An acquaintance who climbed Glenora Mountain on July 2 told us of seeing a marmot on the heights above the timber. We ran across more or less sign on the bare ridges above Doch-da-on Creek in July; on July 23 one of the animals was

seen there, far above the timber, too wary for a near approach. On Kirk's Mountain, some miles north of Doch-da-on Creek, Dixon heard a number of marmots whistling.

At Flood Glacier some marmots were residing in rock piles at the base of the mountain, several miles back from the river but at a not much higher altitude. Dixon shot two here on August 1, an adult male (no. 31005) and a young one, perhaps a quarter grown (no. 31004). The species was not encountered farther down the river.

The marmots of the mountains about Doch-da-on Creek and Glenora may well be *Marmota caligata oxytona* Hollister. This would be at about the western limit of that subspecies. The adult male from Flood Glacier has a large skull, well within the limits of *oxytona*, and exhibiting the characters of that race as detailed by Howell (1915, p. 63), but in external measurements this animal is no larger than coastal specimens of the subspecies *caligata*. The young male from Flood Glacier is at the same stage of growth as a young *caligata* at hand from the mouth of the Chickamin River, Alaska, and the two are indistinguishable in appearance. The peculiarities of the skull in the adult may be an indication of intergradation between *caligata* and *oxytona* in the middle reaches of the Stikine, but the material at hand does not suffice to settle that point.

#### **Citellus plesius plesius** (Osgood). Bennett Ground Squirrel

On June 4 two ground squirrels were taken at the Summit (nos. 30994, 30995), and one other was seen. This same place was visited on May 29 and again on June 5 without any animals being encountered. It was still quite wintry at that altitude, with much snow on the ground and ice on the lakes, and it seemed likely that most of the ground squirrels were still in hibernation. M. P. Anderson had found them in abundance at the Summit in July and August, 1902 (Allen, 1903, p. 534). The species occurs in the Stikine region only on the mountain slopes above timber line; it is found nowhere in the lower valleys.

The three animals seen were all observed within a radius of two hundred yards. There were a number of fresh looking burrows at the same place. These holes were scattered, though sometimes there were two or three fairly close together; some were amid thickets of low bushes, others out in the open meadows. They were small, considering the size of the animal, and there were no noticeable mounds of earth at the entrances. Of the two animals collected, the stomachs

were well filled with masticated moss and lichens. The female contained four small embryos. Anderson (Allen, *loc. cit.*) in 1902 collected young squirrels "one-fourth to one-half grown" at the same place on July 31.

When we were at Glenora two acquaintances who were camped nearby made a trip to the summit of Glenora Mountain, which rises just north of the town. They reported an abundance of ground squirrels on the slopes above the timber. We kept a careful lookout for the species on the mountains above Doch-da-on Creek where the surroundings were apparently ideal, but saw none of the animals nor any burrows or other certain sign of their presence.

***Eutamias borealis caniceps* Osgood. Gray-headed Chipmunk**

Of general distribution in the region about Telegraph Creek and Glenora; not abundant but apt to be encountered anywhere in the lowlands. At Doch-da-on Creek chipmunks were noticeably less abundant, and the species was not seen at all farther down the river. While apparently mostly at low altitudes, chipmunks were sometimes found well up the mountain sides. On July 11 one was seen at timber line (about 3000 feet) above Doch-da-on Creek.

Dandelions were a favorite food. Toward the end of June and in July these were going to seed, and chipmunks were constantly seen stripping the fluffy heads. Individuals had certain favorite spots for eating, and at such places there were heaps of dandelion fuzz and parts of the blossoms.

Twenty-eight specimens were collected (nos. 30946-30973), as follows: Telegraph Creek, fifteen adults; Glenora, five adults; Doch-da-on Creek, two adults and six young.

The chipmunk of the Telegraph Creek region was identified as *Eutamias caniceps* by Allen (1903, p. 533). Preble (1908, p. 169) considers *caniceps* as a subspecies of *Eutamias borealis*, and I am here following his opinion. No topotypes of *caniceps* nor any examples of *borealis* have been available for comparison.

***Sciurus hudsonicus hudsonicus* (Erxleben). Northern Red Squirrel**  
***Sciurus hudsonicus picatus* Swarth. Northwest Coast Red Squirrel**

Red squirrels were not abundant at any point visited by us in the upper Stikine Valley, though seen in small numbers almost everywhere. About Telegraph Creek and Glenora from five to ten individuals might

be encountered in the course of a day's walk. At Doch-da-on Creek they were less numerous, due perhaps to their having been incidentally killed by the systematic trapping that had been carried on during the previous winter over much of the ground we covered at that point. At Flood Glacier and Great Glacier, red squirrels were extremely scarce. We realized, of course, the fact that this species occurred as two different geographic races, at the mouth of the Stikine and at the head of the river, respectively, and that there was probably continuous distribution of the species for the entire length of the stream. We



Fig. X. Thicket of wild cherry (*Prunus demissa*) at Telegraph Creek. This shrub grows in abundance in that region; by the middle of June the bushes are covered with white flowers. The gray-headed chipmunk was characteristically found in such surroundings as are here shown, on rather broken ground that was grown up with bushes of this sort. Photograph taken June 15, 1919.

realized also that in all probability somewhere near Flood Glacier or Great Glacier was the critical point where the two subspecies meet, and for that reason we bent every effort toward getting specimens from those stations. However, not more than two or three were seen at each place. At Sergief Island, too, red squirrels were scarce.

Altogether we collected twenty specimens (nos. 30974-30993), fifteen adults and five young, from the following localities: Telegraph Creek and vicinity, ten; Glenora, two adults and one young; Doch-da-on Creek, three full-grown young; Flood Glacier, one; Great Glacier, one; Sergief Island, one adult and one young. The Telegraph Creek speci-

mens were taken at various points between that town and the Summit, twelve miles to the northward. Six specimens from Telegraph Creek were submitted to Mr. E. A. Preble, of the United States Biological Survey, for subspecific determination. His conclusion is that these squirrels are "virtually identical with *Sciurus h. hudsonicus*. In some respects, notably in the color of the back, they show some slight approach to *S. h. petulans* of the coast. They agree, however, with *hudsonicus* as regards the color of the fringe of the tail." The Glenora and Doch-da-on Creek specimens are clearly in the same category as the Telegraph Creek specimens; they are all *S. h. hudsonicus*. The squirrels from Flood Glacier, Great Glacier, and Sergief Island are just as unequivocally *S. h. picatus*.

As between *hudsonicus* and *picatus*, there are differences of color and of the skull. Red squirrels from Doch-da-on Creek (three full-grown young) are in both respects typical of *hudsonicus* and they represent the farthest point down stream at which this subspecies was taken. Our next collecting station was Flood Glacier, some forty miles down the river, and, as noted, there was taken at that point but the one red squirrel, typical of *picatus*, both as regards color and skull. Whether there actually is a stretch of country in this intermediate region where red squirrels are as scarce as our experience seems to indicate, or whether we were merely unlucky in the necessarily limited areas our field work covered at Flood Glacier and Great Glacier, remains still to be determined. It may be, of course, that there is actually a notable scarcity of the animals throughout this intermediate region, that there is some attribute of the country that is unfavorable to the red squirrel, and hence serves to keep apart these two subspecies. (For the use of the name *Sciurus hudsonicus picatus* see Swarth, 1921b, p. 92.)

We gained but little information regarding the life history of the red squirrel in the region explored. Near the Junction individuals were several times seen to enter holes in the ground, holes that, from their appearance, evidently served as homes. Squirrel nests were sometimes seen in the trees, but they were not numerous. Females collected May 25 and 26 contained embryos, four and five in number, and about 30 millimeters long. A young male shot at Glenora, July 2, is about two-thirds the length of an adult, and about a quarter the weight. The three young ones from Doch-da-on Creek, taken July 14, 17, and 22, respectively, are nearly full-grown, being but slightly below adults in measurements and weight.

The first red squirrel collected near Telegraph Creek, on May 26, had almost completely finished the molt into the summer pelage. Others shot during the next two weeks are either in the winter pelage throughout or else variously advanced in the change, showing ragged patches of the old coat. Those taken farther down the river are all in summer pelage.

An adult female taken at Glenora July 4 (no. 30986) has the incisors of both jaws malformed so that they could not meet, the two lower teeth passing together to the left of the upper ones. All four had grown to abnormal length, but not so much so as to endanger the animal's life. They were evidently worn down somewhat by the friction sideways; the teeth are beveled, but not on the same plane as in normal individuals. This squirrel was in good condition, in fact there was some fat under the skin. A western goshawk collected at Flood Glacier contained in its stomach the remains of a red squirrel; doubtless all the hawks of the region prey upon this species to some extent.

TABLE V

Measurements in millimeters of *Sciurus* from the Stikine Region and from southeastern Alaska

<i>Sciurus hudsonicus hudsonicus</i>					Total length	Tail vertebrae	Hind foot	Ear
30975	♂	Telegraph Creek, B. C.	May 29, 1919		330	130	47	17
30976	♂	Telegraph Creek, B. C.	May 29, 1919		315	125	48	17
30977	♂	Telegraph Creek, B. C.	May 29, 1919		330	127	47	17
30978	♂	Telegraph Creek, B. C.	May 29, 1919		332	122	48	16
30982	♂	Telegraph Creek, B. C.	June 18, 1919		330	125	50	18
30983	♂	Telegraph Creek, B. C.	May 27, 1919		330	133	50	19
30987	♂	Doch-da-on Creek, B. C.	July 22, 1919		300	120	48	17
<i>Sciurus hudsonicus picatus</i>								
30991	♂	Great Glacier, B. C.	Aug. 10, 1919		310	122	47	14
30993	♂	Sergief Id., Alaska	Sept. 4, 1919		300	115	45	13
Average measurements of 8 males from southeastern Alaska					312.37	125.37	50.75	....
<i>Sciurus hudsonicus hudsonicus</i>								
30974	♀	Telegraph Creek, B. C.	May 26, 1919		320	120	50	16
30979	♀	Telegraph Creek, B. C.	May 30, 1919		320	125	47	16
30980	♀	Telegraph Creek, B. C.	May 31, 1919		325	125	46	16
30984	♀	Glenora, B. C.	July 1, 1919		320	130	44	14
30986	♀	Glenora, B. C.	July 4, 1919		295	127	44	17
<i>Sciurus hudsonicus picatus</i>								
30990	♀	Flood Glacier, B. C.	July 31, 1919		293	109	47	16
30992	♀	Sergief Id., Alaska	Sept. 2, 1919		300	114	48	14
Average measurements of 8 females from southeastern Alaska					308.25	123.0	51.25	....

**Lepus americanus macfarlani** Merriam. Mackenzie Varying Hare

We were told that some years rabbits occurred in abundance in the country about Telegraph Creek, but we were there during a period of scarcity, and they were all but totally absent. As evidence of former abundance we found scattered through the woods many crumbling rabbit skeletons, bleached and weathered, which had lain there for a year at least, perhaps longer. On June 18 fresh rabbit tracks were seen in the dust of a trail some five or six miles west of Telegraph Creek, and on July 7 a young rabbit about two-thirds grown (no. 31003) was taken near the Stikine River opposite Glenora. No others were seen, nor any indication of their presence, at any other point.

**Castor canadensis canadensis** Kuhl. Beaver

An abundant species on the lower Stikine, where the many miles of flooded bottom lands, the mazes of winding channels and sloughs, and the abundant forest growth, all combine to make conditions that are well-nigh ideal for the beaver. Above "the Cañon" the species is scarce. There are undoubtedly many obscure little ponds hidden in the woods and blind sloughs and channels running back from the river that still shelter small and scattered colonies, but the beavers have been so nearly extirpated in this region that trapping is no longer profitable.

A few miles from Telegraph Creek there were beaver ponds, some of considerable size, but we were told that the beavers had long been wiped out. At Glenora, one evening, the resounding "plop" of a beaver's tail in the water near the river's edge gave evidence of one survivor, at least. Near Doch-da-on Creek, several miles back from the river, there was a series of ponds, all occupied by beavers, though so many had been caught there during the several years immediately preceding our visit that there were probably but few still left.

At Flood Glacier and at Great Glacier beavers were seen, and also abundant evidence of recent activities. At Farm Island, just above Sergief Island, at the mouth of the river, Dixon found a colony of some size, and on September 5 he trapped two at that point. These two specimens (nos. 31013, 31014), immatures, probably born the preceding year, were the only ones taken.

This material is too scanty to definitely determine the subspecific position of the beaver of the Stikine region, but it may be said that the two animals obtained are appreciably paler in coloration than *phaeus*, of Admiralty Island, or even than *leucodonta*, of Vancouver Island.

We saw trappers' skins, also, from various points on the Stikine, and they all appeared to be paler colored than *phaeus*. It seems safe to assume that but one subspecies of beaver occurs over the entire length of this river, and apparently it is a relatively pale-colored form. There are probably beavers on the mainland coast of southeastern Alaska wherever conditions are suitable, and also on most of the islands. From this whole general region, however, specimens are available only from Admiralty Island, where the dark colored *Castor c. phaeus* occurs. Whether this form occupies a habitat more extensive than this one island, and the extent of the area on the coast of Alaska that is occupied by the paler colored subspecies of the Stikine region, are points that still remain to be ascertained.

#### **Odocoileus columbianus sitkensis** Merriam. Sitka Deer

No deer nor any sign of their presence was seen until we reached the mouth of the river. At Sergief Island the fresh tracks of one individual were seen on the beach during the first week in September. Deer are fairly numerous on the nearby Farm Island, but they seldom cross over to Sergief. Dixon spent several days (August 26-29) on a trip to Mitkof Island. Deer are abundant there, as on most of the islands of the Alexander Archipelago, and on August 28 three were shot. One of these (no. 31012), a spike buck, was preserved as a specimen.

#### **Alces americanus gigas** Miller. Alaska Moose

The most important game mammal of the region and the main source of fresh meat for the residents of the country. We were told that twenty or thirty years ago moose were scarce in the Telegraph Creek region and almost unknown farther down the river, and that they had steadily increased in numbers since that time. At present they are abundant. We saw fresh sign everywhere we went, in the immediate vicinity of each of our camps (including points within two miles of the town of Telegraph Creek), and as far down the Stikine as the Great Glacier. Moose are known to occur regularly even farther down stream, and we were told of one being killed at the river's mouth some years ago. On the mountains above Doch-da-on Creek fresh moose tracks and droppings were seen just above timber line, at about 4000 feet elevation.



At the Junction, on May 27, Dixon was going quietly through the poplar woods in search of birds when a cow moose suddenly burst forth from a clump of alders some thirty yards away and charged viciously upon him with mouth open and neck bristles all on end. When she was within fifteen yards and still coming, he fired a load of dust shot, whereupon she swerved to one side and went off through the trees. A search of the bushes from which she had emerged disclosed a newly born calf, still unable to do more than totter about on its long and very wobbly legs.

Dixon's observations upon this animal read in part as follows:

When first found, on the very spot where it was born, the calf was not frightened but came up to me, whining like a puppy dog. Later this low whine was found to be a usual call note of the youngster. The moose characters of large ears, overhanging nose, high shoulders, low rump, and long legs, were all conspicuous. The face and particularly the ears, were much lighter colored than the body. An incipient mane of black hairs showed as a narrow line from the back of the head to a point just back of the shoulders. The metatarsal glands were conspicuously colored by a patch of whitish hairs covering an area one inch long by one-half inch wide. The body was clothed with thick warm hair, plumbeous at the basal half, then brown, and with a faint tipping of black. In walking on level ground the young moose stood 30 inches high at the shoulder and 27 inches at the rump. The distance from the nose to the tip of the tail in life was 30 inches.

The sense of hearing was most keen, sight second, and smell last. A cracking twig always startled her violently. The upper eyelid had eyelashes over an inch long, which helped to keep the myriad mosquitoes out of the eyes. A swarm of these bloodthirsty pests were sucking blood from the helpless youngster when first discovered.

In attempting to nibble grass the little moose knelt down on her front legs, and in this position was able to bite off the tender grass with her eight sharp lower incisors, well developed even in this 24 hour old calf. Attempts were also made to nibble budding willow twigs. In lying down she knelt on her front legs first, then the posterior was lowered and the long hind legs tucked up under or to one side of the body. In getting up, the animal rose to its knees on its front legs, and then the hind quarters were raised. By mid afternoon the young moose followed me about the camp so that I had difficulty in keeping far enough away to use the camera.

### **Rangifer osborni** Allen. Cassiar Caribou

We ourselves were at no time in caribou territory, and my only reason for including the species here is to place on record information received regarding the distribution of this animal. Telegraph Creek is the outfitting place of hunters who visit the region each fall, and many caribou are killed by them, but the mountains where the hunting is usually done are reached by long pack trips to the northward and eastward.

We were told by the caretaker at Mr. Callbreath's farm, across the river from Glenora, that a band of ten or twelve caribou had spent the previous winter on the unforested summit of Glenora Mountain, where he had often watched them with a field glass. This may represent the extreme western point reached by the species in this region. Twenty-five miles farther down the river there are other mountains with extensive areas rising above timber line, which have been hunted over for many years past by Captain A. B. Conover, residing at the mouth of Clearwater Creek. He told us that he had never seen any caribou there, nor any sign of their presence.



Fig. Y. Young Alaska moose (*Alces americanus gigas*), twenty-four hours old. The long legs of the adult moose is a feature that is much accentuated in the calf, giving an appearance of extreme ungainliness to the short-bodied animal, whether standing upon these stiltlike members or lying down with the legs awkwardly folded underneath. Photograph taken near Telegraph Creek, May 27, 1919.

**Oreamnos montanus columbianus** Allen. Columbian Mountain Goat

Mountain goats are probably of general distribution on the higher mountains from Telegraph Creek west to the coast. Our own experiences were limited to three localities. At Glenora, on July 3, an acquaintance ascended the mountain that rises behind the town, and he told us that he saw two goats near the summit. On July 11 and 23 we climbed the mountain just south of Doch-da-on Creek. As soon as the belt of upright timber was passed, goat sign was seen on all sides. Broad, well-beaten trails wound through the thickets of prostrate

balsam, to split again and again and finally become indistinguishable on the open grass-covered slopes above. The balsam branches along the trails were decorated with streamers of long white hair, caught from the shedding animals as they passed along. Recently occupied beds could be distinguished at many points, and numerous footprints and droppings all attested to the presence of mountain goats in some numbers. We saw none here, however, though on the 11th, when we started to descend the mountain toward evening, fresh tracks were seen at one point where a goat had crossed our trail since morning.

Four days, July 16 to 19, were devoted by Dixon to a hunt on the mountain above Kirk's Creek, some eight or ten miles north of Dochda-on Creek. He saw a number of the animals and shot an adult male (no. 31008). Several were in sight at once when this one was killed, and Dixon's observations on the behavior of the remainder of the band include some interesting items. His notes read in part as follows:

While we were skinning our specimen another goat came back, and after grazing about awhile laid down against a granite boulder, where, with head propped up against a stone, he watched us as we worked. Although we were in plain sight and only 150 yards away, he lay there placidly observing us. As soon as I started to sneak down out of sight, in an attempt to approach near enough to get a photo, the goat got up and went over the ridge and across a narrow ravine, where he stood waiting, watching me as I came over the crest of the ridge 100 yards away. I followed him over the next ridge and saw him disappear down a snow slide toward a hanging valley below. From this latter point I searched the cliffs above me with the binoculars, and saw a goat lying in a niche in the cliff, high above me. This animal lay motionless with outstretched neck, watching me intently. Going around the ridge out of sight at one side of the cliff, I worked my way up to a level with him, then edged around the cliff so that when I stepped out in sight I was less than thirty feet distant. The goat bounded to his feet, then slowly and deliberately jumped from niche to niche along the face of the cliff until a slide was reached. Here he bounded and slid down, scattering the rocks as he went. The spot where he had been resting, about the center of the cliff, was like the eyrie of a golden eagle, and about as difficult of access. It seemed incredible that so large an animal could ever have reached it along the face of the cliff. A man certainly could not have done so. .

His tracks led across a snow slide to a cavity at the south side of a large boulder. The snow melting away from the rock left a hole about six feet long, three feet wide and four feet deep, and in here the goat had lain down, resting on the snow and peering at me over the brink. Only the dark eyes and horns could be seen, the otherwise white coloration blending perfectly with the snow. I walked down to within 100 feet of the animal and took two photos while he lay perfectly still. Then I crawled to the edge of the snow bank, too steep for me to cross, and threw rocks at him. Arising, at first he stood his ground, stamping his fore feet or making feints at charging me. I finally struck him with a stone and he jumped to the edge of the snow bank, where he stood with arched neck and tail erect as though in challenge. Then he started down the

snowslide. With hind legs flexed and spread well apart, and front legs rigid, almost on his haunches, he slid and wriggled in safety down the dangerous slide, which at the bottom dropped over a precipice. At the top of this cliff he crossed to the solid rock beyond, and then turned to see if I was coming.

The goat taken was a male, fully mature but not of great age. His weight was estimated at two hundred pounds. This animal has almost none of the long shaggy covering with which we usually associate the species. It is white, just as in winter, but the hair is extremely short. Over much of the body there is no more than a scanty covering of tightly curled wool, which presumably would develop later into a dense body covering, completely hidden by the long straight hairs of the winter coat.

*Oreamnos montanus columbianus* was described from the Shesley Mountains, in the same general region and some sixty or seventy miles north of the place where our specimen was taken (see Allen, 1904, p. 20). Mountain goats occur on the mountains along the mainland coast of southeastern Alaska directly to the westward of this region, and with very little doubt at all suitable places between. Whether or not the subspecies *columbianus* extends westward to the coast we have not the material to decide, though the specimens at hand suggest otherwise. There are three specimens available from the coast of southeastern Alaska, an adult female and two young males. The old female has horns that are nearly as widespreading as in a female *Oreamnos kennedyi*, from Cook Inlet, of about the same age. They are more widespreading than in our adult male from the Telegraph Creek region. These are the only comparisons that it is feasible to make. This material thus suggests the possibility at least of the existence of a coastal race, *kennedyi*, as distinct from *columbianus* of the interior. In all probability *kennedyi* should be regarded as a subspecies of *Oreamnos montanus*, rather than a distinct species. There is with little doubt sufficiently continuous distribution of mountain goats along the Alaskan coast to insure intergradation between the several described forms, and the goat occurring on the mainland of the Sitkan region may well prove to be referable to *kennedyi*, though perhaps not exhibiting the characters of that race in their extreme.

## CHECK LIST OF BIRDS

1. *Colymbus holboelli* (Reinhardt).
2. *Colymbus auritus* Linnaeus.
3. *Gavia immer* (Brünnich).
4. *Larus philadelphia* (Ord).
5. *Sterna paradisaea* Brünnich.
6. *Mergus americanus* Cassin.
7. *Anas platyrhynchos* Linnaeus.
8. *Nettion carolinense* (Gmelin).
9. *Spatula clypeata* (Linnaeus).
10. *Dafla acuta* (Linnaeus).
11. *Marila*, sp.?
12. *Glaucionetta islandica* (Gmelin).
13. *Histrionicus histrionicus* (Linnaeus).
14. *Oidemia deglandi* Bonaparte.
15. *Branta canadensis occidentalis* (Baird).
16. *Ardea herodias fannini* Chapman.
17. *Gallinago delicata* (Ord).
18. *Pisobia maculata* (Vieillot).
19. *Pisobia minutilla* (Vieillot).
20. *Totanus melanoleucus* (Gmelin).
21. *Totanus flavipes* (Gmelin).
22. *Tringa solitaria cinnamomea* (Brewster).
23. *Actitis macularia* (Linnaeus).
24. *Oxyechus vociferus vociferus* (Linnaeus).
25. *Dendragapus obscurus flemingi* Taverner.
26. *Dendragapus obscurus sitkensis* Swarth.
27. *Canachites canadensis osgoodi* Bishop.
28. *Canachites canadensis atratus* Grinnell.
29. *Bonasa umbellus umbelloides* (Douglas).
30. *Lagopus leucurus leucurus* (Swainson).
31. *Zenaidura macroura carolinensis* (Linnaeus).
32. *Circus hudsonius* (Linnaeus).
33. *Accipiter velox* (Wilson).
34. *Astur atricapillus atricapillus* (Wilson).
35. *Astur atricapillus striatulus* Ridgway.
36. *Buteo borealis calurus* Cassin.
37. *Buteo swainsoni* Bonaparte.
38. *Aquila chrysaetos* (Linnaeus).
39. *Haliaeetus leucocephalus alascanus* C. H. Townsend.
40. *Falco peregrinus pealei* Ridgway.
41. *Falco columbarius columbarius* Linnaeus.
42. *Falco sparverius sparverius* Linnaeus.
43. *Asio flammeus* (Pontoppidan).
44. *Cryptoglaux funerea richardsoni* (Bonaparte).
45. *Bubo virginianus*, subsp.?
46. *Glaucidium gnoma*, subsp.?
47. *Ceryle alcyon caurina* Grinnell.
48. *Dryobates villosus monticola* Anthony.
49. *Sphyrapicus varius varius* (Linnaeus).

50. *Sphyrapicus varius ruber* (Gmelin).
51. *Colaptes auratus borealis* Ridgway.
52. *Chordeiles virginianus virginianus* (Gmelin).
53. *Cypseloides niger borealis* (Kennerly).
54. *Chaetura vauxi* (J. K. Townsend).
55. *Selasphorus rufus* (Gmelin).
56. *Sayornis sayus* (Bonaparte).
57. *Nuttallornis borealis* (Swainson).
58. *Myiochanes richardsoni richardsoni* (Swainson).
59. *Empidonax difficilis difficilis* Baird.
60. *Empidonax trailli alnorum* Brewster.
61. *Empidonax hammondi* (Xantus).
62. *Empidonax wrighti* Baird.
63. *Otocoris alpestris arcticola* Oberholser.
64. *Cyanocitta stelleri stelleri* (Gmelin).
65. *Perisoreus canadensis canadensis* (Linnaeus).
66. *Corvus corax principalis* Ridgway.
67. *Corvus brachyrhynchos caurinus* Baird.
68. *Euphagus carolinus* (Müller).
69. *Pinicola enucleator flammula* Homeyer.
70. *Carpodacus purpureus purpureus* (Gmelin).
71. *Loxia curvirostra bendirei* Ridgway.
72. *Loxia curvirostra sitkensis* Grinnell.
73. *Loxia leucoptera* Gmelin.
74. *Leucosticte tephrocotis littoralis* Baird.
75. *Spinus pinus pinus* (Wilson).
76. *Calcarius lapponicus alascensis* Ridgway.
77. *Passerculus sandwichensis savanna* (Wilson).
78. *Passerculus sandwichensis alaudinus* Bonaparte.
79. *Zonotrichia leucophrys gambeli* (Nuttall).
80. *Zonotrichia coronata* (Pallas).
81. *Spizella monticola ochracea* Brewster.
82. *Spizella passerina passerina* (Bechstein).
83. *Junco hyemalis connectens* Coues.
84. *Junco oreganus oreganus* (J. K. Townsend).
85. *Melospiza melodia rufina* (Bonaparte).
86. *Melospiza melodia caurina* Ridgway.
87. *Melospiza lincolni gracilis* (Kittlitz).
88. *Passerella iliaca unalaschensis* (Gmelin).
89. *Passerella iliaca fuliginosa* Ridgway.
90. *Piranga ludoviciana* (Wilson).
91. *Petrochelidon lunifrons lunifrons* (Say).
92. *Hirundo erythrogaster* Boddart.
93. *Iridoprocne bicolor* (Vieillot).
94. *Tachycineta thalassina lepida* Mearns.
95. *Riparia riparia* (Linnaeus).
96. *Bombycilla garrula pallidiceps* Reichenow.
97. *Vireosylva gilva swainsoni* (Baird).
98. *Vermivora celata orestera* Oberholser.
99. *Vermivora celata lutescens* (Ridgway).
100. *Vermivora peregrina* (Wilson).
101. *Dendroica aestiva aestiva* (Gmelin).

102. *Dendroica coronata hooveri* McGregor.
103. *Dendroica townsendi* (J. K. Townsend).
104. *Seiurus noveboracensis notabilis* Ridgway.
105. *Oporornis tolmiei* (J. K. Townsend).
106. *Wilsonia pusilla pileolata* (Pallas).
107. *Setophaga ruticilla* (Linnaeus).
108. *Anthus rubescens* (Tunstall).
109. *Nannus hiemalis pacificus* (Baird).
110. *Certhia familiaris occidentalis* Ridgway.
111. *Sitta canadensis* Linnaeus.
112. *Penthestes atricapillus septentrionalis* (Harris).
113. *Penthestes gambeli abbreviatus* Grinnell.
114. *Penthestes rufescens rufescens* (J. K. Townsend).
115. *Regulus satrapa olivaceus* Baird.
116. *Regulus calendula calendula* (Linnaeus).
117. *Regulus calendula grinnelli* W. Palmer.
118. *Myadestes townsendi* (Audubon).
119. *Hylocichla ustulata ustulata* (Nuttall).
120. *Hylocichla ustulata swainsoni* (Tschudi).
121. *Hylocichla guttata guttata* (Pallas).
122. *Hylocichla guttata nanus* (Audubon).
123. *Planesticus migratorius migratorius* (Linnaeus).
124. *Planesticus migratorius caurinus* Grinnell.
125. *Ixoreus naevius naevius* (Gmelin).
126. *Ixoreus naevius meruloides* (Swainson).
127. *Sialia currucoides* (Bechstein).

## GENERAL ACCOUNTS OF THE BIRDS

### *Colymbus holboelli* (Reinhardt). Holboell Grebe

A pair was nesting on Sawmill Lake in June. They kept far out on the lake, but with binoculars we were able to determine their specific identity.

### *Colymbus auritus* Linnaeus. Horned Grebe

Small grebes were seen on Sawmill Lake several times during June, always at a great distance, and on June 12 a pair was seen on Alkali Lake.

### *Gavia immer* (Brünnich). Common Loon

At least one pair on Sawmill Lake. The birds were quiet and unobtrusive, never being heard calling at that point. Another pair, encountered in a small lake near Doch-da-on Creek, was more noisy, and our arrival at the lake shore was invariably heralded by an outburst of sound from both birds. At that time, the middle of July, they were caring for two young, apparently about a third grown. The four birds were almost always seen together.

**Larus philadelphia** (Ord). Bonaparte Gull

One or two flocks were seen just after we passed Dixon Entrance, going north, on May 19. They were apparently migrating, the only migrants in evidence at that time, and were traveling in a manner characteristic of the Bonaparte gull, but different from most of our other species. The flocks were in compact formation and flying swiftly, more like large waders than gulls in appearance; there was no soaring whatever, and no lingering.

A single Bonaparte gull was seen on Sawmill Lake, June 17. A small gull seen flying up stream past our Flood Glacier camp on August 4 was, probably of this species.

**Sterna paradisaea** Brünnich. Arctic Tern

On our trip up stream, May 21 to 23, terns believed to be of this species, were seen at intervals up to within thirty miles of Telegraph Creek. On July 14, at Doch-da-on Creek, several were flying about over some sand bars in midstream; from then on they were noted at various times and places, always far out over the river.

**Mergus americanus** Cassin. American Merganser

On May 21, mergansers were seen in fair abundance at the mouth of the Stikine; they lessened in numbers as we went up stream, and finally disappeared, none being observed above "the cañon." Those that came near enough for identification were all *M. americanus*.

Later in the summer, at Flood Glacier, at least two different broods of mergansers were seen, but of what species could not be ascertained. On July 29 a family of ten or twelve plunged into the stream opposite our camp, hotly pursued by a bald eagle. The eagle was very much in earnest, but it was curious to see, once the water was reached, the indifference with which the mergansers regarded their formidable pursuer. None took the trouble to dive, even, except the one specifically selected as a victim. Then, at the last moment, that particular individual disappeared easily beneath the water, leaving the eagle floundering and gathering himself for another try at the flock. He soon gave up the task, and the mergansers swam down stream out of our sight.



**Anas platyrhynchos** Linnaeus. Mallard

A single bird, seen June 12 in a beaver pond some five miles west of Telegraph Creek, was the only indication we had that this species might be breeding in the upper Stikine Valley. Ducks are quiet and retiring during the nesting season, however, and we spent but little time in places where we would be apt to find them, so that our negative results are no proof of the actual scarcity of this and some other species.

At Sergief Island, August 17 to September 7, mallards were present in considerable numbers. All that we shot proved to be young birds.

**Nettion carolinense** (Gmelin). Green-winged Teal

A pair was seen June 12 in a beaver pond some five miles west of Telegraph Creek. At Sergief Island, toward the end of the summer, teal were present in abundance, usually in flocks of ten or twelve individuals. Two specimens were preserved, an immature male taken on September 2 (no. 39705), and an adult female, September 5 (no. 39706).

**Spatula clypeata** (Linnaeus). Shoveller

A single bird was seen at close range in a slough on Sergief Island on August 29. A Peale falcon shot at the same locality on September 1 had the remains of a shoveller in its stomach.

**Dafla acuta** (Linnaeus). Pintail

Seen only at Sergief Island. There, during the whole of our stay, pintails were present in fair abundance, usually in flocks of ten or twelve individuals. These small flocks were, presumably, each a single family.

The three common fresh-water ducks here were the mallard, green-winged teal, and pintail. Of none of these species, seen almost daily from August 17 to September 7, and in considerable numbers, were any male birds seen in the normal adult winter plumage. Presumably the old males were still in the eclipse plumage, but our efforts to obtain any failed; those birds that we shot proved to be young of the year, with one or two old females.

**Marila**, sp.? Scaup Duck

Flocks and single birds were several times seen on Sawmill Lake during June. Most of them were males (on June 11 a flock was noted

consisting of ten males and one female), suggestive of the possibility that the females were sitting on eggs nearby. The birds were seen at close enough range to identify them as scaups, but whether *Marila marila* or *M. affinis*, or both, would, of course, have required the capture of specimens for determination.

***Glaucionetta islandica* (Gmelin). Barrow Golden-eye**

Seen at various points within ten or twelve miles of Telegraph Creek: at the Summit, June 4 and 5, a flock of five females and several single birds, both male and female; at Sawmill Lake, occasionally during June; and on a small stream south of Telegraph Creek. Two females were shot at the Summit, June 5, and one of them was preserved (no. 39707). These two birds were evidently not breeding.

The species encountered was apparently *Glaucionetta islandica*. The identity of the one specimen saved was determined mainly through a study of the characterization of the two forms, *americana* and *islandica*, as given by Brooks (1920, p. 356). This decision, though, is also influenced by the fact that the adult males seen were unquestionably *islandica*, the triangular white facial patch being plainly discernible with the binoculars. This is a curious instance, in which the identity of a specimen in hand (a normal adult female) is confirmed by sight identification of others not obtained.

***Histrionicus histrionicus* (Linnaeus). Harlequin Duck**

Not seen along the lower Stikine River, but fairly common along the upper part of the stream. Frequently observed at close range from the river boat, always seen in swift water, flying up when approached too nearly, or perhaps swimming fearlessly through a swirl of rapids alongside, paying little heed either to the boat from whose path it just withdrew, or to the rocks and snags between which it picked its way. Seen as far up the river as Telegraph Creek.

***Oidemia deglandi* Bonaparte. White-winged Scoter**

Undoubtedly nesting on Sawmill Lake, where varying numbers were seen during the month of June. Twenty or more of both sexes were noted on June 17, and lesser numbers on many other occasions. Not met with elsewhere.

***Branta canadensis occidentalis* (Baird).** White-cheeked Goose

We were told of the occasional, though rare, occurrence of geese as far up the river as Telegraph Creek, but it seems doubtful that birds seen so far inland should be *occidentalis*. In our ascent of the Stikine River, May 21 and 22, flocks of geese, presumably of this subspecies, were seen at intervals about as far up as Great Glacier. None was seen by us during the summer any farther inland. When we camped at Great Glacier in August, we found an abundance of old "sign" of the presence of geese, many droppings on the sand bars about some shallow ponds, and the marks of webbed feet in sticky mud that had since remained undisturbed. The geese themselves had probably not visited the place for many weeks. These ponds, in a sheltered location, apparently received a maximum of sunshine early in the summer, and were correspondingly attractive to the birds at that time.

In our descent of the river, the first white-cheeked geese were seen at the boundary, August 16. From there on down an occasional small flock was noted, but not until the mouth of the river was reached were they seen in any numbers. At Sergief Island they were abundant. Flocks of large size frequented the marshes at that point, changing their feeding ground as the tides advanced and receded. These local movements covered but a few miles at most, and, of course, were gone through with daily as regularly as the tides. Aside from this hourly shifting, which kept some flocks on the wing practically throughout the day, there was no appearance of migration. Flocks of white-cheeked geese were never seen to depart in a manner suggestive of the beginning of a long flight, nor were any seen arriving as though from a distance.

During the last two weeks in August the geese were still molting extensively. In some the breast and belly were almost entirely devoid of feathers, only the down remaining, and nearly all were renewing the tail feathers. Flight feathers were fully grown, or at any rate sufficiently so for flying. Presumably the birds would not gather upon these open and exposed marshes until they could fly; nesting and the beginning of the molt, including loss of the remiges, probably takes place in more sheltered localities.

Five specimens of white-cheeked geese were preserved, an adult male and adult female saved entire (nos. 39708-39709), and two males and a female (nos. 39710-39712), of which head and neck only were preserved. Four of the five specimens preserved have more or less

indication of a black line on the chin separating the white cheek-patches. In one case this bar is fairly well defined, though as each separate feather is narrowly edged with white and has a white base, a mottled effect is produced. In three the black is not continuous, merely a string of disconnected black spots, and in one the white patch extends uninterruptedly from cheek to cheek. Usually in the geese of this region there is either a string of disconnected spots, as in the specimens just described, or else a beginning of such a line extending forward and backward on the center of the throat but not meeting. Very rarely the black dividing line is continuous, broad, and well defined. I, myself, have seen two such specimens, but in neither case was there absolute assurance that they were birds breeding in the Sitkan district. Such birds might occur as migrants from a more northern region, where intergradation of *occidentalis* and *minima* might result in the occasional appearance of such a marking.

***Ardea herodias fannini* Chapman.** Northwest Coast Heron

Only two seen during the entire summer. One observed on a sand bar in the Stikine River some eight miles below Telegraph Creek on July 5 may or may not have been of the coast subspecies, *fannini*. One was seen flying overhead on Sergief Island, September 5.

***Gallinago delicata* (Ord).** Wilson Snipe

Seen only at Sergief Island. At that point, during the whole of our stay, August 17 to September 7, Wilson snipe were abundant on the marshes, not generally distributed, but always to be found about certain favored spots, generally near fresh-water ponds. While the usual manner of occurrence was for a single bird to be flushed, or perhaps two or three within a few square yards, there were times when snipe were noted in small flocks, almost like sandpipers in their actions. Groups of ten or twelve individuals were seen circling about through the air, in close formation and wheeling or turning in perfect unison. At such times almost the only thing to betray the identity of the birds was the call note, uttered at frequent intervals. At no time, however, did birds flushed from the ground depart in flock formation. Eight specimens were collected (nos. 39713-39720), taken on dates ranging from August 18 to September 1.

***Pisobia maculata* (Vieillot). Pectoral Sandpiper**

Seen only at Sergief Island. Upon our first visit to the marshes, on August 18, pectoral sandpipers were seen in small numbers, just a few single birds, or, at most, two or three together. They increased in numbers daily, and by September 1 flocks of from twenty to thirty individuals were frequently encountered. Like the Wilson snipe, they favored the fresh-water ponds, and there they could be seen walking about through the short grass, the flocks loosely spaced so that the individual birds were from ten to twenty feet apart. They were tame and unsuspicious, usually permitting a near approach. Three specimens preserved (nos. 39721-39723).

***Pisobia minutilla* (Vieillot). Least Sandpiper**

Seen only at Sergief Island, where it was present in fair abundance. The small size of the least sandpiper kept it out of the grassy areas frequented by some of the other waders, and it was usually found on the bare mud banks or sand bars. There were places, however, where the flocks of geese had trampled down the tall marsh grass, sometimes acres in extent, and the least sandpipers were fond of feeding in such spots, where they could run about freely over the prostrate grass. One specimen collected (no. 39724).

***Totanus melanoleucus* (Gmelin). Greater Yellowlegs**

Seen only at Sergief Island. Not abundant, but a few single birds and sometimes two together were encountered at various times from August 19 to September 2. One specimen collected (no. 39725).

***Totanus flavipes* (Gmelin). Lesser Yellowlegs**

Seen during June about Sawmill Lake and some smaller ponds near Telegraph Creek. Probably nesting somewhere within a few miles, but apparently not in the immediate vicinity of these lakes. Occasionally one was seen coming down from a great height in the air, evidently to feed on the shores of one or another of the lakes. It seemed likely, from the birds' actions, that the nesting grounds might have been in meadow land high up in some of the nearby mountains. Four specimens preserved, all adults (nos. 39726-39729).

***Tringa solitaria cinnamomea* (Brewster). Western Solitary  
Sandpiper**

This species might be expected to breed throughout the region in which we were working, but we failed to find it doing so. It was met with but once during the summer, an immature male (no. 39730) being secured at Flood Glacier on August 7. This individual, a fully grown bird of the year, was, of course, a migrant, and might have traveled a long distance.

***Actitis macularia* (Linnaeus). Spotted Sandpiper**

Fairly common in the upper Stikine Valley. A nest with four eggs was discovered at Sawmill Lake, June 14, placed in a bank of sawdust on the site of the long abandoned sawmill. At Glenora a set of four eggs (no. 1806) was collected on July 3. The nest in this case was in a grassy meadow near an abandoned building. Another nest was found at Glenora, on a sand bar at the edge of the river. At least one brood was hatched near our camp at Doch-da-on Creek. No spotted sandpipers were seen farther down the river, but there is no reason to doubt that the species occurs the whole length of the Stikine. It is known to be a summer visitant on the coast of southeastern Alaska. One specimen collected (no. 39731), an adult female taken at Glenora with the set of eggs previously referred to.

***Oxyechus vociferus vociferus* (Linnaeus). Killdeer**

On the evening of August 22, Dixon heard the unmistakable notes of a killdeer from a mud bank in the river near our camp at Sergief Island. Search the next day, and for several days thereafter, failed to bring the bird to our sight, but the call note is so distinctive that a person familiar with the species could not mistake it for any other.

***Dendragapus obscurus flemingi* Taverner. Fleming Grouse**

In summer, at least, this species is restricted to high altitudes in the mountains of the upper Stikine region. We met with it at but one point, at timber line, in the mountains above Doch-da-on Creek. A female with a brood of small young was seen there, at about 4000 feet elevation, on July 11. On July 23, two broods were found near the

same place, the young ones the size of mountain quail (*Oreortyx*), strong on the wing, and apparently well able to care for themselves. On July 11 a cock bird was flushed from the heather at the edge of a snow bank, far above the timber. Another was seen by Dixon at the upper edge of the timber on Kirk's Mountain on July 17. No males were heard hooting at any time.

Of the two broods seen on July 23, one consisted of three young, the second of but one. These birds were found in open, grassy patches, close to dense and extensive thickets of prostrate balsam fir, that afforded shelter from almost any enemy. The parent of the brood of small young seen on July 11 was extremely solicitous for their safety. She was not aggressive in her solicitude, however, as is the ruffed grouse under similar circumstances, nor did she feign a broken wing or other disability. She simply sat on the top of a thicket, obviously greatly worried, clucking nervously to the chicks until they had reached what she considered a safe distance, when she followed after through the bushes. The larger young ones seen on July 23 were evidently expected to look after themselves to a great extent; they were as wary and resourceful as their parents.

Five specimens were secured (nos. 39732-39736), two adult females and a male and two females in juvenal plumage. These birds appear to belong to the subspecies *Dendragapus obscurus flemingi*, described by Taverner (1914, p. 385), from Teslin Lake, one hundred and forty miles north of the Stikine. This form is most nearly related to *D. o. richardsoni*; it is widely different from *fuliginosus* and *sitkensis*, the coastal subspecies. *Richardsoni* and *flemingi* are not "hooters." The call note of the male bird is not the loud, far-reaching hoot that is so characteristic of *fuliginosus* and *sitkensis*, and also of the California race, *sierrae*. In these latter subspecies the male bird has on each side of the neck an area of bare skin that is brilliant yellow, greatly thickened, and capable of wide distention, part of the hooting apparatus and not highly developed in the non-hooting forms. (See Brooks, 1912, p. 252.) This is a structural difference of sufficient importance to warrant the specific separation of these groups of grouse. Whether or not *D. o. obscurus* of the southern Rocky Mountains is a hooter I do not know, and any changes of nomenclature would hinge upon this fact.

*Flemingi* is described as differing from *richardsoni* in darker general coloration and in having the tail rounded, not truncate. Both are described as lacking a terminal tail band. The general dark color-

tion, including extension of dark areas and restriction of light ones, is evident in the Stikine birds, as in topotypes of *flemingi* loaned me by the Victoria Memorial Museum, and is sufficiently marked to justify the recognition of *flemingi*. It is doubtful whether the tail characters are valid. The sharply truncate tail of the male *richardsoni* is a feature that is not acquired until the second year at least. The young male, the first year, has the whole tail rounded, and the individual tail feathers are narrow and rounded as compared with the broad, truncate feathers of the old bird. Also, *richardsoni* can hardly be said to lack entirely a terminal band on the tail. An indication, at least, of this marking is always present.

***Dendragapus obscurus sitkensis* Swarth. Sitka Grouse**

On May 21, on the trip up the river from Wrangell, we stopped at the Canadian custom house, just above the Alaska-British Columbia boundary, and while anchored there heard a grouse hooting in the nearby woods. Presumably this was the coast subspecies. The only specimen collected during the summer was an adult female (no. 39737) taken by Dixon at the southern end of Mitkof Island, during a three days' hunt for deer which he made to that point, August 26 to 29. A number more were seen at the same place. (For the use of the name *Dendragapus obscurus sitkensis* see Swarth, 1921a, p. 59.)

***Canachites canadensis osgoodi* Bishop. Alaska Spruce Grouse**

***Canachites canadensis atratus* Grinnell. Valdez Spruce Grouse**

From the reports we heard it is to be inferred that the spruce grouse is of general distribution in the region we visited, and in fair abundance though locally restricted to suitable surroundings. We were informed that about Telegraph Creek this grouse was usually found in the spruce forests on the hillsides well up above the river valley. We, ourselves, met with the species at but two points. Late in the evening of July 5, as we were returning to our camp at Glenora, a young spruce grouse flew up into a tree by the road and was taken. It was still partly in the natal down, too young to be supposed to be shifting for itself, but neither the parent nor any other of the brood was seen.

At Flood Glacier an adult female and one chick were taken on August 4, an adult male on August 7. No others were seen. These birds were collected in dense spruce woods, in the bottom lands between the river and the glacier. The old male was feeding on huckleberries.



Of the specimens collected, the adult male (no. 39740, August 7) had virtually completed the annual molt. There are partly grown feathers over various parts, but the old plumage is all discarded. The adult female (no. 39739, August 4) is still mostly in the worn, last year's plumage, though feather renewal is in progress in some tracts. The two young (no. 39741, male, Glenora, July 5; no. 39738, female, Flood Glacier, August 4) are at precisely the same stage of development, though taken just a month apart. The natal down persists upon head, throat and belly, and the juvenal feathers clothe the back, breast, flanks, and wings.

The two adults are noticeably different from examples of *Canachites c. osgoodi* from points in the interior. Of the latter I have had for comparison specimens from various points in northern British Columbia, Yukon, and Alaska. *Osgoodi*, described from Lake Marsh, some 250 miles north of Telegraph Creek, is a grayish colored bird, compared with other races of *C. canadensis*, a character that becomes more and more accentuated to the northward. Birds from the Kowak River region reach the extreme of differentiation in this regard (see Grinnell, 1900, p. 30). Our Flood Glacier adults are extremely dark colored, matching exactly examples of the coastal race, *Canachites c. atratus*, from Prince William Sound, Alaska (Grinnell, 1910, p. 380). *C. c. atratus* was not admitted to the *Check-List* by the A. O. U. Committee (1912, p. 385), its characters being deemed "insufficient for recognition," but it seems to me to be a recognizable form. The inference resulting from the capture of our Stikine birds is that that race of spruce grouse will prove to be of continuous distribution in the coastal district between the Stikine River and Prince William Sound.

The two young birds, from Glenora and Flood Glacier, respectively, are somewhat different in appearance. The Glenora bird is more grayish in coloration, the Flood Glacier specimen more rufescent and with more extensive black areas upon individual feathers. These differences might pass unnoted, perhaps, were it not for the peculiarities of the Flood Glacier adults as compared with typical adult *osgoodi*. As it is, I believe the observed differences in the juvenals to be of significance, for they are just the sort of differences that would be expected to distinguish the young of *atratus* and *osgoodi*. The Glenora juvenile may be an example of *Canachites c. osgoodi*. This indicates the possible presence of two forms of *Canachites canadensis* in the Stikine Valley (as is the case with so many other species of birds), *C. c. osgoodi* of the interior extending westward at least to Glenora, *C. c. atratus* of the coast extending inland at least to Flood Glacier.

**Bonasa umbellus umbelloides** (Douglas). Gray Ruffed Grouse

Fairly common in the poplar forests of the upper Stikine Valley. We ourselves saw none below Doch-da-on Creek, but the species undoubtedly ranges farther down stream, regularly. We were told of its occasional occurrence at the mouth of the river, but whether breeding or merely in winter I do not know.

During the first week in June single birds were several times seen at the Junction. Three that were shot at this point were all males; the females were undoubtedly sitting on eggs at that time. On June 12 the first young were seen, two broods being encountered near Telegraph Creek. The young of one brood were still unable to fly. Our first knowledge of their presence was derived from the mother bird, who burst forth from the bushes and charged us furiously. She kept tail and ruff widely spread, the head crest depressed. She was mewling in a very catlike fashion, and also hissing from time to time. There was an occasional faint *peep* from the grass nearby, and once I caught a glimpse of a yellow chick slipping away through the shrubbery, but the young were too agile to be captured.

The young of the second brood were somewhat larger and able to fly. This second mother tried to toll us away from the chicks by feigning a broken wing; the noise she made was not unlike the whining of a small puppy. Her actions, all together, gave the impression that she was frightened rather than angry. However, if frightened, she still did not desert her trust, but remained nearby, dragging herself back and forth across the road, with wings drooping and all her feathers pressed closely against her body. Her tail was not spread nor were her ruffs displayed at any time, all in striking contrast to the behavior of the first bird met that morning.

From later observations it appeared that these two parents were fairly typical of their kind in such an emergency. The mother either charged the intruder viciously, in an apparent attempt to frighten him, or else she endeavored to distract attention from the chicks to herself by feigning injury and inviting pursuit. On one occasion the parent of a brood came charging at me through the woods from a distance of fifty yards.

At Doch-da-on Creek, July 8 to 26, ruffed grouse were seen on many occasions. On July 15 an adult male was shot that proved to be in the midst of the molt; only one or two of the old rectrices were left and the body was covered with pin feathers. On July 18 the last drumming was heard.

The series collected comprises four adult males, one adult female, one in juvenal plumage, and one in natal down (nos. 39742-39747). These birds are relatively gray colored, but not so ashy as *Bonasa umbellus yukonensis*, from the Yukon region (see Grinnell, 1916, p. 166). I have had for comparison three specimens of *Bonasa u. umbelloides* from points on the Saskatchewan and Athabasca rivers, Alberta, practically topotypes of that form, loaned me by the United States Biological Survey. The Stikine River birds are of exactly the same type of coloration.

Of our series of five adults, three are in the gray phase, two in the red. Apparently these color phases occur throughout the entire range of the species *Bonasa umbellus*. The point arises as to whether the confusion that exists between the subspecies *umbelloides* and *togata* (cf. A. O. U. Committee, 1910, p. 140), a relatively gray race and a relatively reddish one, is not largely due to a misunderstanding of the color variation within any one subspecies. No attempt has been made by me to go thoroughly into this question, but it may be said that the reddest *umbelloides* examined is a very different looking bird indeed from the few grouse I have seen from eastern Canada, the habitat of the reddish colored *togata*.

The crop contents of two ruffed grouse from the Stikine region (determined at the United States Biological Survey) are as follows:

No. 39742, adult male. Percentage of vegetable matter, 100. Contents of crop: 1 pupa of plant louse, many leaves and a few stems of *Populus trichocarpa* (75 per cent), leaves, stems, etc., of *Galium triflorum* (25 per cent), 1 leaf of *Artemisia*, sp., and bits of leafy moss.

No. 39748, adult male. Percentage of vegetable matter, 100. Contents of crop: 105 leaves of *Populus tremuloides* and a few bud scales of the same (90 per cent), 9 berries and a leaf of *Viburnum pauciflorum* (10 per cent), bits of vegetable debris.

### **Lagopus leucurus leucurus** (Swainson). White-tailed Ptarmigan

Met with at but one place, on a mountain above Doch-da-on Creek. Here, on the heather covered slopes above the timber, two broods were seen on July 11. Of one, the entire family was obtained, the adult female and three downy young (nos. 39749-39752). The second lot, a female with seven or eight young, escaped.

While we were camped at Glenora an acquaintance climbed Glenora Mountain, nearby, and informed us that he saw a single ptarmigan

on the summit during the day. This same man had spent several winters trapping on the Iskut River some miles above the junction of the latter with the Stikine, and he told us that at times ptarmigan were plentiful there during the winter months. He described them as of two species, one smaller and entirely white (obviously *leucurus*), the other larger and with black feathers in the tail. The latter was evidently either *rupestris* or *lagopus*; both species may occur there.

The three young taken on July 11 are in the natal down throughout, save that the wing feathers had grown out to a slight extent. They could fly a little, skimming down hill a few inches above the ground.

The crop contents of these birds (determined at the United States Biological Survey) are as follows:

No. 39749, adult female. Percentage of vegetable matter, 100. Contents of crop, fragments of mosses, a few leaves of *Geranium*, sp., 24 flowers of *Dryas octopetala* (25 per cent), many leaves, stems, etc., of *Salix*, sp. (75 per cent).

No. 39750, young. Percentage of animal matter, 30; of vegetable, 70. Contents of crop: 1 *Scymnus*, sp., at least 1 *Sciara*, sp., about 50 plant lice (including *Psylla*, sp.) (30 per cent); vegetable matter, including *Myrica gale*, unidentified leaf buds (probably *Salix*, sp.), and *Ranunculus*, sp. (70 per cent).

No. 39751, young. Percentage of vegetable matter, 100. Contents of crop: fragments of several leaf buds, probably *Salix*, sp.

No. 39752, young. Percentage of animal matter, 60; of vegetable, 40. Contents of crop: 12 plant lice and several unidentified leaf buds, probably *Salix*, sp.

***Zenaidura macroura carolinensis* (Linnaeus). Eastern Mourning Dove**

On June 17 a mourning dove was seen near Telegraph Creek. Mr. W. H. Dodd, who has been government agent at that point for some years past, informed me that the species occurs in the fall with a fair degree of regularity. That is, one or two of the birds might be expected to appear each year.

On September 3 an adult female (no. 39753) was collected on Sergief Island, at the mouth of the Stikine River. Mr. Fred H. Gray, of Wrangell, a deputy of the Bureau of Fisheries, and a man who has observed and collected birds for many years, informed me that he had

seen mourning doves in and about Wrangell on several occasions. Mr. Allen Hasselborg, of Juneau, once informed me of seeing a dove near that city, in November, 1911. Straggling individuals have been recorded from Metlakatla, British Columbia (Kermode, 1904, p. 28), from Sitka, September 14 (Willett, 1914, p. 81), and from Hydaburg, Prince of Wales Island, September 1 (Willett, 1917, p. 22).

The bird I took was flushed from tall marsh grass, at a point that was regularly covered by the tides. In many places on the marsh this grass was beaten down by rain or wind, and it was from one of these flattened patches that the dove was flushed.

If southeastern Alaska is an unusual point of occurrence for the species, at any rate this individual reached the place without suffering any undue hardships, for it was excessively fat. The crop contents of this bird were as follows: percentage of animal matter, 1; of vegetable, 99; of gravel, etc., a trace. Contents of crop: 16 Oribatid mites and 2 young *Polygyra*, sp., 1 per cent; 9 *Carex*, sp., 4 per cent; 388 *Alsi*ne, sp., 20 per cent; 221 *Impatiens*, sp., 75 per cent.

The Sergief Island specimen, compared with examples of *Zenaidura macroura marginella* from California, is darker colored throughout, with richer brown coloration on scapulars, and with larger black spots upon the latter. It is not *marginella*. It bears closer resemblance to the eastern form, *Zenaidura macroura carolinensis*, and for the present may remain under that name. There is not enough material available to demonstrate whether the birds that occasionally reach southeastern Alaska really are examples of the eastern race, extending northwestward into northern British Columbia and sometimes to the coast, or northern strays of the coastal subspecies, *Z. m. caurina*, described by Ridgway (1916, p. 348) from Oregon.

### **Circus hudsonius** (Linnaeus). Marsh Hawk

First noted at Sergief Island on September 3, when two brown immatures appeared, beating over the marsh. A number more were seen during the next few days.

### **Accipiter velox** (Wilson). Sharp-shinned Hawk

Not seen until the close of the nesting season. First noted at Flood Glacier, August 3, next on August 6, and thereafter almost daily. At Great Glacier, on August 11, a Steller jay was shot and wounded, and, being retrieved, screamed loudly. Almost instantly a sharp-shinned hawk appeared, evidently drawn by the cries of distress, and lit in a tree as near by as he dared to come.

Two specimens collected, an immature male at Great Glacier, August 11 (no. 39754), and an immature female at Sergief Island, August 22 (no. 39755).

***Astur atricapillus atricapillus*** (Wilson). Eastern Goshawk

***Astur atricapillus striatulus*** Ridgway. Western Goshawk

Goshawks doubtless occur in summer throughout the region east of the coast ranges, but apparently in widely scattered pairs. We saw them at various localities, single individuals encountered at considerable intervals of time. At our camp at the Junction, the end of May, a recently dropped wing quill was evidence of the passage of one of the birds. One was seen flying overhead at the Summit, May 29, another at Glenora, July 7. On July 11 an adult male was shot at the upper limit of timber (about 3000 feet altitude) on the mountain above Doch-da-on Creek. On August 4 an immature female was taken at Flood Glacier. This bird contained in its stomach the remains of a red squirrel.

The adult male collected (no. 39756) is referable to the eastern subspecies, *Astur atricapillus atricapillus*, and is, I assume, representative of the form that inhabits the entire region east of the coast ranges. The young bird taken at Flood Glacier (no. 39757) may or may not have been hatched in that immediate neighborhood. No other goshawks were seen there, and other species of hawks (pigeon hawks and sharp-shinned hawks) were at that time beginning to appear, apparently migrating. At any rate, this individual appears to be an example of the western subspecies, *A. a. striatulus*. It is closely matched by four young of *striatulus* from their nesting ground in the Warner Mountains, California, and it is quite unlike a series of six immatures of *atricapillus* from the Yukon region. Compared with the Yukon series the Flood Glacier bird is darker colored throughout, it is more heavily marked below, and the brown edgings to the feathers dorsally are broader and of a darker brown. Specimens of *striatulus* taken on the coast of southern Alaska during the migrations are closely similar to the Flood Glacier bird.

***Buteo borealis calurus*** Cassin. Western Red-tailed Hawk

Red-tailed hawks were seen at several points in the interior, but never in any numbers. Two or three were noted near Telegraph Creek at close enough range to enable their rufous tails to be distinguished; some dark colored hawks, supposed to be of this species, were seen at

a distance. At Glenora, July 1, an extremely dark individual was seen, the body almost black; this again was identified by means of the characteristic tail color. Others were observed at Doch-da-on Creek, during July.

All the birds of this species seen thus far had been either in the dark phase or else were light breasted birds that were not notably light colored otherwise. Then, at Flood Glacier, a family of extremely light colored individuals was encountered. On July 26, and on subsequent days, an adult red-tail was several times seen from our camp, sometimes perched in a tall spruce, sometimes flying past. The breast and belly of this bird appeared to be gleaming white, and the back seemed to have much white spotting.

On July 31 Dixon found this adult feeding two full-grown young ones in an opening in the forest; though the parent was too wary to be captured, he took both the immatures. These, like the old one, are extremely light colored. Chin, throat and breast are continuously white, the breast with a buffy suffusion, and the lower abdomen and lower tail coverts are white. In the spotted tract across the middle of the body below, and on the flanks, the dark spots are relatively small and separated by wide areas of white. The area immediately surrounding the eye, and between eye and bill, is white. In the feathers on the top of head and back of neck are small central spots of black or dusky, and extensive basal and marginal areas of white. Over the entire upperparts the feathers are extensively white spotted and with broad margins of white or pale buffy.

In a large series of young *calurus* from various parts of the western United States we have nothing at all like these birds. An immature male *borealis* from Wisconsin is like the Stikine River specimens in the uniformly white chin, throat, and breast, and in the restriction of the black spots below, but it is not so white on the head and upperparts. *Buteo borealis krideri* has been recorded from Alaska on the basis of a light colored bird taken at Eagle during the winter of 1903 (B. H. Bailey, 1916, p. 321). The red-tails, however, form a puzzling aggregation of geographical races and color phases, and it does not simplify matters in this case to assign to the subspecies *krideri* a range covering part of the habitat of *calurus*. The present writer is disinclined to regard the light colored birds just described as examples of *krideri*, thereby extending the range of that form far to the westward. Most of the red-tails seen throughout the Stikine region were of the recognized *calurus* type. Until the meaning of the diverse phases of

plumage seen is thoroughly understood it is safer to regard all the birds of that part of the country as of the one subspecies, *calurus*.

Of the two young birds collected, the female had crop and stomach filled to distention. In the partly digested mass there could be distinguished the remains of at least four mice and one toad. The mice could be identified as *Microtus mordax*. The male bird had its stomach filled with a mass of *Microtus* bones and hair. The meadow mice that the young hawks had eaten must all have been fed to them by their parents. While *Microtus mordax* was a fairly common species at that point, still it is noteworthy that a red-tailed hawk should be sufficiently agile to catch so many of them in as short a space of time as must have been the case. The mice in the river bottom, where the hawks were found, were in cover so dense that it was surprising to find a red-tail there at all. The hunting of the latter, may of course, have been done on the nearby mountain sides, above the denser timber, but even so it seems rather remarkable that they should find so little difficulty in catching these small rodents.

#### ***Buteo swainsoni* Bonaparte. Swainson Hawk**

Seen only in the vicinity of Telegraph Creek. A number of dark colored hawks were observed thereabout, some of which were identified as red-tails, while others of lighter build were assumed to be of the present species. Dixon shot one on June 1, but was unable to find the bird until two days later, when it was unfit to preserve as a specimen. One wing, one leg, and the tail were preserved (no. 39760) to make identification certain. The birds seen were undoubtedly nesting near-by.

#### ***Aquila chrysaëtos* (Linnaeus). Golden Eagle**

One seen at fairly close range near Telegraph Creek on June 22, another at Glenora, July 7.

#### ***Haliaeetus leucocephalus alascanus* C. H. Townsend**

##### **Northern Bald Eagle**

In all probability bald eagles extend inland much farther than the points where we were collecting, dependent perhaps upon local conditions, but we ourselves did not see any farther up the river than Doch-da-on Creek. Here, the latter part of July, they were noted on several occasions. On July 23 two were seen circling above the mountain tops, at about 5000 feet altitude. Descending the Stikine from Doch-da-on Creek, bald eagles were seen at various points.



On our trip up the river in early May, many nests were noted along the lower parts of the stream, easy to see at that season as the trees were still bare of leaves. On our return trip in August the abundant foliage hid most of the structures, but one at least was noted (on August 16) with a young bird still sitting on the edge of the nest. At Sergief Island bald eagles were seen daily.

**Falco peregrinus pealei** Ridgway. Peale Falcon

One shot on the marsh at Sergief Island on September 1. This bird, an immature of the year, differs appreciably from the mode of young *anatum*, as represented by specimens from various parts of North America. The main difference consists in the Sergief Island specimen being more heavily marked beneath, in its almost totally lacking the cinnamon tinge below that is so characteristic of *anatum*, and in the lack of paler edgings to the feathers of the upperparts. This falcon contained in its stomach the remains of a shoveller (*Spatula clypeata*).

**Falco columbarius columbarius** Linnaeus. Pigeon Hawk

Not seen until the latter part of the summer, when the migration had begun. If the species breeds throughout the region we were exploring, it is to be supposed that the birds are few in numbers and in widely scattered pairs. First seen at our Flood Glacier camp, August 1, next, on our way down the river to the Great Glacier, August 8. On Sergief Island, the latter part of August and the first week in September, pigeon hawks were seen almost daily, but they were wary and seldom came within shooting distance.

Two specimens were secured, a female at Great Glacier, August 14 (no. 39762), and a male (no. 39763) at Sergief Island, September 2. Both are immatures. The Sergief Island bird is an average example of *columbarius* at that stage. The Great Glacier specimen is darker colored. Below, it is indistinguishable from *columbarius*, but dorsally it is about as dark as examples of immature *suckleyi* from Vancouver Island. On the whole, it is best referred to *columbarius*.

**Falco sparverius sparverius** Linnaeus. American Sparrow Hawk

Seen from time to time in the vicinity of Telegraph Creek, generally not far from the river. There were probably several pairs nesting within a few miles of the town. At Doch-da-on Creek, in July,

sparrow hawks were seen several times. On July 11 one was observed at about 3000 feet altitude, sitting on a tall dead stub on a burnt-over hillside. On July 23 an adult female was secured at the upper limits of timber, about 4000 feet. At Flood Glacier, August 5, a sparrow hawk was seen several times swooping at a bald eagle that spent that day moping in the rain on the top of a dead tree near our camp. At Sergief Island, sparrow hawks were noted on several occasions. The only previously reported occurrences of this bird in southeastern Alaska seem to have been the capture of one on the lower Taku River, September 16, 1909 (Swarth, 1911, p. 63), and the observation of two at Craig, Prince of Wales Island (Willett, 1921, p. 128), but it is probable that the sparrow hawk is of fairly regular occurrence in the fall at some points on the southern Alaskan coast.

The bird taken at Doch-da-on Creek (no. 39764), an adult female, is essentially like the Taku River specimen referred to, also a female. They are both noticeably dark colored, as compared with California birds, with broader black cross bars on the dorsal surface, and with the rufous areas of a darker shade.

It seems safe to say that the sparrow hawk, as occurring in this general region, is a bird of the interior, and that a few individuals find their way to the coast in the dispersal that takes place in the late summer or early fall. Such migrants would be likely to wander down some large river valley that extends from one region to the other, and it is near the lower ends of such valleys that most of the birds thus far recorded have been seen.

### ***Asio flammeus* (Pontoppidan). Short-eared Owl**

One seen on the marshes of Sergief Island on September 2, presumably a migrant from some other place. As these same marshes had been assiduously hunted over for two weeks previously without seeing any of this species, it is fair to assume that the bird noted represented the arrival of its kind at this point on the southward flight.

### ***Cryptoglaux funerea richardsoni* (Bonaparte). Richardson Owl**

One specimen, a young bird, molting into first winter plumage, obtained in dense spruce woods at Flood Glacier, July 28. This species, presumably of general distribution throughout northern British Columbia, is a bird of the interior, not known to occur in the humid coast belt, and our specimen may be assumed to have been taken at the extreme western limit of its range in this region.

**Bubo virginianus**, subsp.? Horned Owl

Horned owls occur throughout the country we were visiting, but apparently not in abundance, at least during the summer months. We were told of their presence at Telegraph Creek, but we saw none, nor did we hear any hooting. At Doch-da-on Creek we were shown the desiccated remains of one that had been killed the previous winter. On Sergief Island, August 31, I found a horned owl's feather in the marsh, far from the timber. At the latter point, the subspecies present is doubtless *Bubo v. saturatus*; I had no means of ascertaining the subspecific identity of the horned owl of the upper Stikine River.

**Glaucidium gnoma**, subsp.? Pigmy Owl

One seen at Doch-da-on Creek on July 14, sitting on a dead tree in a clearing. I had a good enough view of the bird to be certain of its specific identity, but it was too wary to permit a near approach. On July 22 one was heard calling at about the same place.

There is available a specimen of *Glaucidium* (no. 41193), a mounted bird, taken at Wrangell, Alaska, date of capture and sex unknown. This bird is not an example of the extremely dark colored *Glaucidium gnoma swarthi* of Vancouver Island, a coastal form that might be supposed to range northward into Alaska. It is closely similar to a specimen of *G. g. grinnelli* from Humboldt Bay, California (no. 24851), an individual that is not of the rufescent coloration usually seen in this subspecies, but of a decidedly duller brown.

The available information, scanty as it is, indicates the occurrence of *Glaucidium* in the upper Stikine Valley and on the Alaska coast at the mouth of the same river. There is little doubt that it ranges through the territory intervening between those two points. Whether or not two subspecies are represented in the two regions on either side of the coastal mountains is something that can be determined only by the capture of specimens.

**Ceryle alcyon caurina** Grinnell. Western Belted Kingfisher

Kingfishers were unaccountably scarce. The region might be supposed to be a favorable one for the species, but it was encountered on just two occasions: one bird seen at Doch-da-on Creek, July 17, and another at Flood Glacier, July 28.

**Dryobates villosus monticola** Anthony. Rocky Mountain Hairy  
Woodpecker

The only species of woodpecker that was at all common in the region. About Telegraph Creek there were but few of the birds seen in May and in early June, but by the middle of June, when the young were beginning to fly, hairy woodpeckers were encountered rather frequently. Farther down the river they were decidedly scarce. A few were seen at Doch-da-on Creek. At Flood Glacier, one bird was taken and one other was heard calling.

Two occupied nests were found near Telegraph Creek. One, discovered June 11, contained nearly full-grown young, which could be seen at the entrance calling for food. This nest was in a partly dead poplar, about twenty feet from the ground. The second, found in an exactly similar situation on June 12, contained one young bird, which left at the first disturbance.

By the third week in June the nesting season seemed to be entirely over, and the young were flying about independently of their parents. An adult male shot June 19 was beginning to molt. New remiges have appeared at the junction of primaries and secondaries, and there are new feathers along the center line of the breast and abdomen.

Hairy woodpeckers may be expected to occur continuously along the Stikine River, thus bringing the subspecies *monticola* and *sitkensis* together. Unfortunately the birds are so rare along the lower river (as in the southeastern Alaskan coast region in general) that it is difficult to get enough specimens to ascertain the nature of conditions where the two meet. We failed to see any at all at the crucial point.

*Sitkensis*, in its relatively light ventral coloration, is intermediate between the extremely dark *harrisi* and the white-breasted *monticola*. The dark breasted type of coloration reaches its extreme development in *picoideus* of the Queen Charlotte Islands, interposed between the ranges of *harrisi* and *sitkensis*. Thus, while specimens of *sitkensis* as laid out in trays may be arranged to illustrate a step between *harrisi* and *monticola*, the geographical distribution of the several forms is not in accordance with this idea. The geographical chains appear to lie as follows: Starting with the white-breasted races of the interior of the northwest, *septentrionalis* and *monticola*, there is an extension westward on the coast of a slightly darker breasted race, *sitkensis*. Starting again with the dark breasted type, *harrisi*, of the Puget Sound region, and going northward, we reach the extremely dark

colored *picoideus*. Thus, *sitkensis* and *harrisi* are really far apart genetically, and the appearance of *sitkensis* as a seeming intergrade between *monticola* and *harrisi* must be explained on grounds other than those of such actual intermediate relationship. *Sitkensis*, as an offshoot of the white-breasted type of the interior, may have arrived at the humid coast at too recent a date to be yet affected by its surroundings to the extent that *harrisi* and *picoideus* have been; or it may be more resistant to such an environment. In either case the slight modification of the clear white breast of *monticola* produced by the humid surroundings would result in an apparent intergrade toward *harrisi*.

In this connection it may be remarked that the highly distinctive avifauna of the southeastern Alaskan coast is, for the most part, composed of species that occur on the Pacific coast farther south and extend northward along a narrow coastal strip, more or less modified in appearance. Most of these birds extend farther north than does the hairy woodpecker of the same region. *Cyanocitta stelleri*, *Penthestes rufescens*, *Junco oreganus*, and the coastal forms of *Melospiza melodia* are all birds of this type, and they all occur farther north than does *Dryobates villosus sitkensis*.

The latter apparently belongs to an aggregation of bird species that has more recently invaded the coast from the eastward along a few favorable avenues of approach. The northern limit reached in such cases would be governed by the chance terminus of the route that happened to open up from the eastward, with, of course, later extension from the new base. Other species in this same category are: *Dryobates pubescens*, *Piranga ludoviciana*, *Bombycilla cedrorum*, *Empidonax traillii*, and perhaps *Geothlypis trichas*. These birds are for the most part not nearly so abundant in the coastal region, nor are they so evenly distributed, as species of the first category listed.

Fourteen specimens of *Dryobates villosus monticola* were collected (nos. 39766-39779), eleven adults and three young. Twelve are from Telegraph Creek, one from Doch-da-on Creek, and one from Flood Glacier.

### **Sphyrapicus varius varius** (Linnaeus). Yellow-bellied Sapsucker

On June 18 an adult male was taken. Immediately after this bird was shot its mate appeared and disclosed the location of the nest. On June 19 another male bird was taken within half a mile of where the first was shot. This was about five miles from Telegraph Creek. The nest referred to was twenty-five feet from the ground, in a dead birch

in rather open woods. The cavity appeared to be newly finished, and was empty. The two birds at the nest drew attention to their presence by their raucous call notes, screams worthy of a large hawk. The second specimen collected was traced through his noisy drumming upon a dead limb.

These three sapsuckers were the only ones that were seen near Telegraph Creek. The first one obtained (no. 39780) is close to typical *varius*. It has no red on the nape, and the red chin and throat patch is separated from the white subauricular stripe by a strip of black, these characters being just as in *varius*. It has less white on the back than most eastern examples of *varius*, but there is one specimen available from Illinois that resembles it closely. Taken by itself, this specimen would pass unquestioned as an example of *varius*. The mate of this bird was not obtained, but it was seen for a brief moment close enough to note that it had a great deal of red about the head, almost obliterating the black pectoral patch. The one collected on June 19 (no. 39781) has the red nuchal stripe, and the red of the chin and throat has obliterated the black malar stripe, invaded the white subauricular stripe beyond, and covers the entire black pectoral patch. In the latter marking the black feathers are tipped with red; the posterior border of this patch is sharply defined against the whitish belly. The dorsal region is but scantily spotted with white. It is just such a specimen as, taken in winter in California, would be defined as an example of *nuchalis* showing a decided leaning toward *ruber*.

Ridgway (1914) regards *varius* and *ruber* as specifically distinct. In the upper Stikine Valley the two forms do appear to meet as separate species, but intergradation through individual variation occurs elsewhere and by that criterion the two should be regarded as subspecies of one species. A parallel case in the Stikine region is found in the thrushes, *Hylocichla ustulata ustulata* and *H. u. swainsoni*. The facts derived from our specimens of *Sphyrapicus* are as follows: At Telegraph Creek we took one typical example of *varius*, and one bird that has more the appearance of a hybrid between two species (*varius* and *ruber*) than an "intergrade" between two such forms, regarded as subspecies. At Doch-da-on Creek, some fifty miles down the river, we collected specimens of *ruber*, specimens absolutely typical of that form (see *postea*, p. 220). We have here no series of intergrades, difficult of allocation and from an intermediate region. There are instead examples of two extremes, *varius* and *ruber*, nesting within a short distance of each other. The one doubtful specimen does not accord with

typical *nuchalis*, but has all the appearance of what a hybrid should be between two distinct species, *varius* and *ruber*. Presumably the form *nuchalis* does not occur this far north.

***Sphyrapicus varius ruber* (Gmelin).** Red-breasted Sapsucker

Five specimens taken at Doch-da-on Creek during July, two adult males, one juvenal male and two juvenal females (nos. 39782-39786). Probably several pairs had nested within the area we covered in this region, for the birds were encountered at widely separated points. There were certain favored spots, one clump of willows and one large birch, in particular, where one or more sapsuckers were seen almost every time we passed. These trees showed large areas of scars, the results of assiduous work by the sapsuckers for a considerable period of time.

The five birds taken are typical examples of the dark colored northern race of the red-breasted sapsucker (*Sphyrapicus v. ruber*). This locality, Doch-da-on Creek, may be regarded as the easternmost limit of *ruber* in this region, yet the race persists in typical form to this extreme boundary. There is no indication of intergradation with *varius* or *nuchalis* at this margin of its habitat, such as might be expected to occur. The relationships of the three forms, *varius*, *nuchalis*, and *ruber*, present an unsolved problem, whether we regard them as species or subspecies. As between *ruber* and *daggetti*, however, there is gradual intergradation exhibited by specimens from intermediate points, such as we are accustomed to see in most geographic races, or subspecies.

***Colaptes auratus borealis* Ridgway.** Boreal Flicker

Fairly common in the vicinity of Telegraph Creek, but so shy and wary as readily to elude observation. The call note was frequently heard, but days might pass during which none of the birds was seen. Usually they kept out of gunshot. The few obtained were taken in dense poplar thickets, where the birds were sometimes observed feeding on the ground.

On June 14 a nest was found containing one egg. On June 15 a female was shot with partly formed eggs in the ovary. None had been laid as yet. On June 17 a nest was found containing newly hatched young. This was in the broken stub of a dead birch, about ten feet from the ground.

A few flickers were seen in the woods about Glenora, perhaps one or two daily. At Doch-da-on Creek a few were seen, at long intervals. None was observed any farther down the river.

Three specimens were obtained (nos. 39787-39789), all adult females, two from Telegraph Creek and one from Glenora. Specifically, they are all purely of the yellow-shafted *auratus* type, as regards color and markings. None shows any admixture of *cafer* characteristics, though the breeding ground of the northwest subspecies of that species (*Colaptes cafer cafer*<sup>2</sup>) approaches this region very closely. No red-shafted flickers were seen by us at any point, though *cafer* may be expected to ascend the Stikine for some distance. Subspecifically the large size of these birds places them with the form *Colaptes auratus borealis* Ridgway (1911, p. 31).

TABLE VI

Measurements in millimeters of *Colaptes auratus borealis* from the upper Stikine Valley

No.	Sex	Wing	Tail	Culmen
39787	♀	162	106	37
39788	♀	163	105	32
39789	♀	160	106	33

### **Chordeiles virginianus virginianus** (Gmelin). Eastern Nighthawk

Abundant at Telegraph Creek. The first was heard calling the evening of June 8, the next day one was seen flying overhead, and soon after the birds became common. The species was about as numerous at Glenora; at Doch-da-on Creek it occurred in lesser numbers. None was seen farther down the river.

Three sets of eggs were taken (nos. 1807-1809). On June 20, a single fresh egg, an incomplete set, was found near Telegraph Creek, laid on the bare ground in open woods. The female, shot before the egg was found, contained a second egg, nearly ready to be laid. A set of two eggs, slightly incubated, was taken June 26 in the same tract of woods. This was an area that had been burned over, leaving a scattering growth of small lodgepole pines, with but little underbrush between. A third set was collected at Doch-da-on Creek, July 18. These were incubated within a few days of hatching. The eggs were placed on the bare ground in an open place in the woods. On all sides, some thirty or forty yards distant, there was dense brush, but the ground was open in the immediate vicinity of the eggs.

<sup>2</sup> For the use of this name for the northwestern flicker, see Palmer, 1916, p. 322.



The parent of the second set was extremely solicitous of their safety. She flew as we approached, coming toward us with a peculiarly halting and uncertain flight, with her tail depressed until it pointed almost straight down, and with her mouth open. Alighting near-by, she wallowed on the ground, thus luring us in pursuit for about twenty or thirty yards, then flew off in a circle through the woods. The parent of the set at Doch-da-on Creek acted quite differently. She left the eggs while the intruder was still some distance away, departing quietly and without any manifestations of solicitude. In just twenty minutes she returned, as secretively as she had left. This course of action was followed without variation on three different occasions.

Four specimens were collected (nos. 39790-39793), two adult males and two adult females. To my eye they are indistinguishable from specimens of *Chordeiles v. virginianus* from the eastern United States.

### ***Cypseloides niger borealis* (Kennerly). Black Swift**

A few seen about six miles from Telegraph Creek on June 12, circling overhead just out of gun shot. From this circumstance the species may be assumed to breed somewhere in that general region. One or two were observed at Glenora early in July. The next place the species was noted was at Great Glacier, where, on the morning of August 9, a flock of fifteen or more was seen.

At Sergief Island, August 17 to September 7, black swifts were abundant, though seen only in cloudy or rainy weather. Then large flocks appeared, as many as seventy-five or a hundred being in sight at once flying over the marshes, the individuals moving about in wide circles, and the flock as a whole moving in a definite path. The birds sometimes flew very low, occasionally skimming along just over the tall grass. A flock would appear, circle about overhead awhile, and then vanish. About fifteen or twenty minutes later, others, or perhaps the same flock, would come in sight again.

Compared with *Aeronautes* and *Chaetura*, the flight of *Cypseloides* (at least as seen thus feeding) is rather slow, a steady sailing with relatively little fluttering of the wings. A high rate of speed can be attained, however, so great that when individuals passed by in pursuit of one another the rush of their wings could be heard to a distance of two hundred yards or more. A weak, chattering note was uttered from time to time, but mostly the birds were silent.

Seventeen specimens were obtained at Sergief Island (nos. 39794-39810), five males and twelve females. It might be supposed that a

series of specimens taken when these birds were collected (August 19-30), would contain a large percentage of immatures, but if such young birds are included in the lot they possessed no features, either of internal anatomy or external coloration that enabled me definitely to recognize them as such. According to Drew (1882, p. 182) the young of this species is appreciably different from the adult in coloration, the dark feathers being extensively white-tipped, both above and below. Of the five males, two have extremely faint light colored tips to the feathers of the lower abdomen and on the lower tail coverts. One of the five has the tail very slightly forked, in the others it is deeply indented. Of the twelve females, one is uniformly dark colored; it has no trace of any whitish tips to the feathers of the lower parts. In the others such markings are present in varying degrees. The dark colored female has a truncate tail, just as do the others. In every individual, both male and female, the sexual organs were clearly visible. They were shrunken in size, as would be expected in adults at that season, but they were never difficult to see, as is so often the case with young birds. The birds collected had entirely finished the annual molt and were all in the new plumage.

***Chaetura vauxi* (J. K. Townsend). Vaux Swift**

On June 26 a single bird was noted some five miles from Telegraph Creek. At Doch-da-on Creek, the middle of July, a few were seen on several different days. At Flood Glacier, August 3 and 5, several were observed, flying low in the rain that was falling, and all traveling down stream.

Two specimens were collected (nos. 39811, 39812), an adult male and an adult female, taken at Doch-da-on Creek, on July 16 and 14, respectively.

***Selasphorus rufus* (Gmelin). Rufous Hummingbird**

Seen at every collecting station, but nowhere in abundance. The species was at Telegraph Creek at the time of our arrival, May 23; at that time it was restricted to the near vicinity of the river, where there were already some flowers in bloom. On the higher slopes the vegetation was not so far advanced, and the hummingbirds were absent.

A nest found at Doch-da-on Creek, July 10, was in a clump of large timber, built near the tip of a spruce limb, about five feet from the ground. The outer surface of the structure was well covered with

lichens. Attention was drawn to this nest by the sudden flight of the two young birds it contained, when approached too closely.

During the second week in July a female hummingbird was repeatedly seen in the vicinity of our camp. On the 14th a male bird was seen going through his courtship flight, associated with this same female, so nesting may have been going on at that date. In the courtship flight the male bird rose slowly to a height of about sixty feet, then swooped down and swung up again for a very short distance. A diagram showing the course of this evolution would be about the shape of a fishhook. When the lowest point was reached, three or four rasping notes were uttered. The evolution finished, he slowly arose once more and repeated the performance. This was done five or six times, when he lit on a nearby limb.

For a hummingbird to appear as a menace to a farm crop was a new rôle for a member of that family, but we heard one such complaint of damage done. Mr. W. E. Parrott, of Sergief Island, had a large strawberry patch, the fruit of which he marketed in the nearby town of Wrangell. Time and again, so he told us, he had seen a hummingbird dash at one of the bright red berries, apparently under the impression that it was a flower, and the bird's bill would be thrust through the fruit, which, of course, was ruined. He had found a number of berries pierced in this way, and was puzzled to account for the damage until he saw a hummingbird in the act.

Two specimens were preserved (nos. 39813, 39814). These are adult males taken at Glenora, June 29 and July 3, respectively.

### ***Sayornis sayus* (Bonaparte).** Say Phoebe

Several pairs seen on the upper Stikine River. At Telegraph Creek at least two pairs were domiciled on different houses in the town. On June 6, one pair was seen at work nest building on a beam over the entrance to Hyland's store. At Glenora, June 29, a nest with young was found in one of the deserted houses of the Hudson's Bay Company. A day or two later the birds were gone and search of the adjoining fields failed to disclose their presence; evidently the brood had at once traveled some distance.

On August 21 an immature female was collected on Sergief Island, perched on some drift far out on the marshes. This, I believe, is the first time the species has been reported from the coast of southeastern Alaska. It is, of course, a transient, perhaps no more than a straggler into that region. The bird collected on Sergief Island had probably wandered there from the interior along the Stikine River.

*Sayornis sayus yukonensis* was described by Bishop (1900b, p. 115) from Glacier, White Pass, Alaska, as a northern form, differing from *S. sayus sayus* in darker coloration and in certain structural details. The subspecies was denied recognition by the A. O. U. Committee (1901, p. 312), nor has it been generally recognized since that time. Grinnell (1909a, p. 206) uses the name *S. s. yukonensis* for a specimen from Forty-Mile, Yukon, which is shown to exhibit the characters claimed for the race by Bishop. The young bird (no. 39815) collected by myself differs appreciably from juvenals from the southwest. It is of darker coloration and has much less rufous on the upperparts, thus agreeing with Bishop's (*loc. cit.*) description of the juvenal plumage of *yukonensis*. Thus the two northern specimens of *Sayornis sayus* in this Museum are of a character to justify the recognition of *S. s. yukonensis*, but the material is so scanty that, rather than formally affix that name to these two individuals, I prefer to let the description of their peculiarities rest as evidence for use at some future time when additional material has been acquired.

**Nuttallornis borealis** (Swainson). Olive-sided Flycatcher

There were a few pairs in the more open wooded country about Telegraph Creek. The birds were extremely shy, not permitting a near approach, and their habit of perching in the tops of tall trees also aided in keeping them out of gun shot. Seen at but the one collecting station.

**Myiochanes richardsoni richardsoni** (Swainson)

Western Wood Pewee

Fairly common about Telegraph Creek. First seen on May 27; a few days later present in numbers. A female shot at Glenora on July 7 had laid part of its set. None seen farther down the river than Glenora, though, as the species is known to occur in summer at some points on the coast of southeastern Alaska (Swarth, 1911, p. 75), it might be expected to range through the entire Stikine Valley.

The birds were extremely shy. They were partial to more sparsely wooded areas, especially burnt-over tracts, where they perched upon dead trees affording a wide outlook. In such places they could seldom be approached to within a hundred yards.

Three specimens collected (nos. 39816-39818), one adult male and two adult females. Besides these birds there are in the Museum collection, specimens from the coast of southeastern Alaska and from

Vancouver Island. A northern race of this species has been designated by Bishop (1900b, p. 116) as *Contopus richardsoni saturatus*. Certain of the characters ascribed to this race may be discerned in some of the specimens from the several points indicated, but these features seem all to be too inconstant to serve in differentiating a northern subspecies.

**Empidonax difficilis difficilis** Baird. Western Flycatcher.

Seen nowhere along the upper Stikine, and the call note is sufficiently loud and characteristic to render it unlikely that we should have overlooked the bird, if present. One specimen, an immature male (no. 39819) taken on Sergief Island, August 19.

**Empidonax trailli alnorum** Brewster. Alder Flycatcher

Occurs in some numbers in suitable willow and alder thickets as far down the river at least as Doch-da-on Creek. One heard calling near Telegraph Creek, May 23. None seen at the Junction, but at Sawmill Lake there were several pairs in the dense thickets bordering the water. Here, at Glenora and at Doch-da-on Creek, our experience was the same. The birds could be heard calling, and occasionally one could be seen in flight through the bushes, but their habitat was so impenetrable and the birds were so shy and wary that they were almost impossible to approach.

After leaving Doch-da-on Creek the alder flycatcher was seen on but one occasion. On Sergief Island, September 3, an immature female was collected in a tangle of alders. The capture of this bird, of course, is no proof that the species breeds on that island, though it has once been recorded from another point on the coast of southeastern Alaska under circumstances apparently indicative of nesting (Swarth, 1911, p. 76).

Two specimens were collected, an adult male near Telegraph Creek, June 18 (no. 39820); and the young bird above mentioned (no. 39821). The adult somewhat resembles *Empidonax t. trailli* in its large bill and short wing, but in general coloration and in character of wing bars, it is clearly *alnorum*. The young bird appears to be a typical example of *alnorum*.

**Empidonax hammondi** (Xantus). Hammond Flycatcher

Abundant on the upper Stikine, where it is largely a bird of the poplar woods. Near Telegraph Creek many were seen during the last

week in May, usually sitting high up in the leafless poplars and conspicuous from their frequently reiterated, sharp *che-bec*. Like the other small flycatchers of the region, they were extremely shy, but, through peculiarities of habit and habitat, Hammond flycatchers were more easily collected than some of the other species. The olive-sided flycatcher and wood pewee, perched upon isolated lookout points, could not be approached unawares. The alder flycatcher was in tangled thickets not to be penetrated save with much labor and with the accompaniment of threshing branches and broken boughs. The Hammond flycatcher was mostly in woods that could be traversed with fair ease, but which yet afforded some cover to the hunter.

The species was quite abundant at Telegraph Creek and at Glenora, and in lesser numbers at Doch-da-on Creek. Several were seen at Flood Glacier, though whether the species breeds at that point we had no means of telling. One was collected at Great Glacier, August 10.

A female shot near Telegraph Creek, May 27, was incubating a set of eggs. One collected June 1 had laid part of its set. An adult male taken at Glenora, June 30, shows the beginning of the molt. An adult female from Flood Glacier, July 27, had renewed a large part of its plumage. Two specimens in juvenal plumage were taken at Flood Glacier, August 3 and 6. A young bird from Great Glacier, August 10, shows the beginning of the molt into the first winter plumage.

It is strange that the Hammond flycatcher has not yet been found on the coast of southeastern Alaska south of Skagway. It is abundant in the interior and approaches the coast quite nearly at some points. It is also abundant in the coastal region farther south, as on Vancouver Island. Consequently it is hard to understand the cause of its exclusion from the southern Alaskan coast.

We collected ten specimens (nos. 39822-39831), seven adults and three juvenals.

### ***Empidonax wrighti* Baird. Wright Flycatcher**

Three specimens taken near Telegraph Creek. This species was not to be distinguished from *E. hammondi* in life; in fact it was not until our return from the field, when the entire collection was brought together, that both species were found to be included in the series of small flycatchers collected. Consequently if there is any difference in local habitat between the two we failed to distinguish it. The three birds taken were obtained at points where examples of *hammondi* were also collected.

These specimens are a male (no. 39832), taken at The Junction, May 28; a female (no. 39833), from Sawmill Lake, June 11, not yet laying; a female (no. 39834), taken four miles west of Telegraph Creek, June 18, containing eggs nearly ready to be laid. These facts point to a somewhat later time of nesting than is the case with *hammondi*.

The species has been reported from Wilson Creek, near Lake Atlin, about 150 miles north of our station, and as far as I know the northernmost point of record (E. M. Anderson, 1915a, p. 13). The specimens we took are typical examples of the species, presenting all the characters of measurements and proportions that distinguish *wrighti* from *hammondi*. No equivocal specimens were collected, that is, none that could not be referred without question to one species or the other.

### **Otocoris alpestris arcticola** Oberholser. Pallid Horned Lark

Seen in small numbers on the mountain tops above Doch-da-on Creek. There, on July 11 and again on July 23, they were found on the open, moss-covered slopes above timber line, associated with rosy finches and pipits. This station is, in a straight line, not more than sixty miles from the coast, farther to the westward than horned larks have been found in this region heretofore. From the mountain we were on, however, we could see many similar peaks and ridges far to the westward, where the species would probably be found could these summits be reached. These mountains are so steep and rough, with such impenetrable forests at the lower levels, and, toward the coast, so frequently encircled by glaciers, that their ascent at most places is extremely difficult. Horned larks may well occur at favorable points but a few miles back from the coast, but the circumstances are such that it is doubtful if this possible habitat will soon be invaded by any collector.

We collected four specimens (nos. 39835-39838), two adult males, one adult female, and one juvenal male. The two adult males, taken July 23, are beginning the annual molt, shown mostly in the wing coverts. The young bird, taken July 23, is in juvenal plumage throughout. Compared with the young of various of the southwestern subspecies of *Otocoris alpestris*, it is extremely dark colored. Ground color of the upper parts is blackish, throat and lower belly are white, and there is hardly a trace of rufous or vinaceous anywhere.

**Cyanocitta stelleri stelleri** (Gmelin). Steller Jay

Closely restricted to the coastal region. On our way down stream we saw the first Steller jay at Flood Glacier, some forty miles up the river from the boundary. At that point one was noted on July 26, another on August 1. At Great Glacier, about ten miles above the boundary, two were observed together on August 11, and proved to be both adult males. The species is sufficiently conspicuous and noisy to draw attention to itself when present, and as the above records constitute all of our observations on the upper river, it is obvious that this jay is of relatively uncommon occurrence in that region.

At Sergief Island many were seen, sometimes under circumstances suggesting migration. They were frequently in small gatherings, seven or eight together, and often on the tidal marshes, far from timber, apparently traveling in a definite direction. When thus seen they were flying by easy stages from one drift log to another, in a southerly direction.

An adult female (no. 39839) taken at Flood Glacier, August 1, is in the midst of the annual molt. Two adult males taken at Great Glacier, August 11 (nos. 39840, 39841), are in the new plumage throughout. Two immatures from Sergief Island (nos. 39842, 39843) obtained on August 23 and 31, respectively, are likewise through the molt, and have fully acquired their first winter plumage. These birds are all typical *stelleri*. Those taken the farthest inland evidently represent extreme points of dispersal from the coast. There is no evidence that *Cyanocitta stelleri stelleri* in this region extends inland to the habitat of *C. s. annectens*, with intergradation between the two forms. *Annectens* probably does not range so far north in British Columbia.

**Perisoreus canadensis canadensis** (Linnaeus). Canada Jay

When we arrived at Telegraph Creek, the fourth week in May, this species was through with its nesting. It was not a common bird nor was it ordinarily noisy or conspicuous. Family groups, old and young together, were seen at several points between Telegraph Creek and the Summit, and single individuals were occasionally encountered slipping quietly through the woods.

This jay was one of several species that appeared to be restricted during the breeding season to a higher zone than that immediately bordering the Stikine River. None was seen nearer the river than The Junction, a point four miles north of Telegraph Creek, several



hundred feet higher in altitude, and about two weeks later in the development of the vegetation. On June 4 at the Summit, a gathering of jays was encountered composed of at least two broods. The old birds were busily engaged in feeding the young, though the latter were also foraging a little for themselves.

We did not see the species either at Glenora or Doch-da-on Creek, but it can hardly be doubted that it occurs at both places. There was at least one brood in the woods about our camp at Flood Glacier. The forest at that point is not of the type most favored by this species, being almost entirely dense spruce woods such as are seen along the coast, and it is questionable whether the occurrence there of this family of *Perisoreus* can be assumed to represent a breeding record. None was seen farther down the river.

Individuals taken the last week in May and the first week in June had in several cases already begun the annual molt. Two adults taken at Flood Glacier on July 28 were in the midst of this molt. Two young birds taken at the same place July 28 and August 6 are molting from the juvenal into the first winter plumage.

There have been available for comparison a series of adult *Perisoreus canadensis canadensis* from Minnesota, and old and young of *P. c. fumifrons* from the Kotzebue Sound and Yukon River regions, Alaska. The Stikine River adults are similar to *fumifrons* in general body color, but have more white on the crown. They resemble *canadensis* in head markings but are rather darker colored. The young birds from the Stikine region are distinctly darker colored, more of a slaty black, as compared with the juvenals from Kotzebue Sound and the Yukon River. This dark type of coloration is a character ascribed to the young of *P. c. canadensis* by Ridgway (1904, p. 366). On the whole, the Stikine River series may be assigned to the subspecies *Perisoreus canadensis canadensis*, though showing a tendency toward *P. c. fumifrons*.

We collected thirteen specimens of the Canada jay (nos. 39844-39856), five adults and four juvenals from points within twelve miles of Telegraph Creek, and two adults and two juvenals from Flood Glacier.

### ***Corvus corax principalis* Ridgway. Northern Raven**

Probably occurs throughout this whole region, but, judging from our observations, not abundant at any point. We were at Telegraph Creek three weeks before we saw one. The first was noted on June 17, and afterwards others were seen on several occasions. At Doch-da-on

Creek ravens were occasionally observed, and at Great Glacier several were seen. There were a few at Sergief Island, seen from time to time, or heard croaking in the distance.

***Corvus brachyrhynchos caurinus* Baird.** Northwest Crow

Seen only at Sergief Island. Here, during the latter part of August and the first week in September, crows were fairly abundant, usually in small flocks. Young birds were still being cared for by their parents, and the gatherings seen were apparently family groups, though sometimes two broods may have joined forces. This bird is strictly a "beach comber," apparently not venturing inland any distance whatever. We saw none above the mouth of the river. No specimens were taken. This form appears in the A. O. U. *Check-List* as a distinct species, but it should be regarded as a subspecies of *Corvus brachyrhynchos* (cf. Rhoads, 1893, pp. 18-21; Ridgway, 1904, p. 272; Oberholser, 1919a, p. 84).

***Euphagus carolinus* (Müller).** Rusty Blackbird

Breeding in the vicinity of Telegraph Creek. There were several pairs nesting about Sawmill Lake, at different points, not in any one gathering or colony. A female shot June 11 was incubating eggs. At Doch-da-on Creek the species was seen about some swampy meadows and lakes during the latter part of July, when young birds, full grown, though still in the juvenal plumage throughout, were being cared for by their parents. The young sat in the willows, while the adults were foraging through the swamps for the food that was hurried back to the squalling youngsters as rapidly as it was found.

Seen at one other collecting station. On Sergief Island, September 5, a single bird passed over my head, out of gun shot, while I was out on the marsh.

Ten specimens collected (nos. 39857-39866), an adult male and female from Telegraph Creek, and eight in juvenal plumage from Doch-da-on Creek. There is an appreciable difference in appearance in the two sexes in juvenal plumage. The young male is much more black beneath the prevailing rusty or yellowish hue of the feather tips.

***Pinicola enucleator flammula* Homeyer.** Kadiak Pine Grosbeak

Apparently rather rare in summer in the upper Stikine Valley. We saw single birds or pairs at scattered points and at long intervals of time; they were always shy and it was with difficulty that specimens were taken.

At The Junction, single red-colored males were seen May 27, 29, and 31. Another was noted some five miles west of Telegraph Creek, June 12. At Doch-da-on Creek, a mated pair was taken July 9, apparently preparing to nest. On July 17, at the same place, a flock of seven or eight was encountered, feeding near the ground in some thick bushes; on July 14 a brilliant red male was seen; on July 22 a dull-colored male was secured. The last mentioned was in full song; it was beyond doubt a breeding bird. On August 2, at Flood Glacier, a red male was seen singing in a tree top near camp.

Five specimens collected (nos. 39867-39871), two adult males from The Junction, May 29 and 31; the mated pair from Doch-da-on Creek, July 9 (the male in the female plumage); a dull-colored male from Doch-da-on Creek, July 22. These were identified as *Pinicola enucleator flammula* by Dr. H. C. Oberholser, of the United States Biological Survey.

***Carpodacus purpureus purpureus* (Gmelin).** Eastern Purple Finch

We had collected during most of the month of June in the vicinity of Telegraph Creek without once encountering this species. Then on July 5, in a section we had previously worked most thoroughly about a mile from Telegraph Creek, we encountered several small flocks of purple finches. Three were taken (nos. 39872-39874), a male and two females, all birds that apparently were just through breeding. The male is in the streaked female plumage, with just one pink feather on the breast. Both females show some reddish on the rump.

These birds are unequivocally of the subspecies *purpureus*, and their capture at this point constitutes, I believe, a material extension of range northwestward. The species probably breeds somewhere within a few miles of where the birds were collected.

***Loxia curvirostra bendirei* Ridgway.** Bendire Crossbill

During the latter part of June a few red crossbills were seen flying overhead in the vicinity of Telegraph Creek. On June 22 a small flock was encountered, apparently a single family, and four birds were collected (nos. 39876-39879), an adult male and three juvenals. It is of interest to note that these birds are of the subspecies *bendirei*, widely different in appearance from the form inhabiting the nearby coastal region of Alaska. This would indicate that the range of the small sized, red crossbill of the Pacific slope of British Columbia and

southeastern Alaska is entirely cut off from that of *Loxia curvirostra minor* of eastern North America through the intervention of the form *bendirei*. The Alaskan bird has been named *Loxia curvirostra sitkensis* by Grinnell (1909b, p. 223), based largely on color characters in the adult male. Birds from Vancouver Island do not exhibit the same sort of differentiation from *minor*, in fact to my eye they are indistinguishable. Nevertheless it seems evident that the Vancouver Island birds also occupy part of the territory that is separated from *minor* by the habitat of *bendirei*. The proper nomenclatural treatment of such a form as the Vancouver Island race of *Loxia curvirostra* is an open question. It seems evident that genetically it is as far from *minor* as is *bendirei*; yet, since the birds from the Pacific and Atlantic regions are indistinguishable in appearance, we call them all by the same name.

The characters ascribed to *L. c. bendirei* by Ridgway (1901, p. 50) are as follows: "Similar to *L. c. minor*, but decidedly larger; adult male averaging rather lighter or brighter in color, the adult female slightly lighter and grayer." These characters are well borne out by the specimens of *bendirei* in the collection of this museum. In addition, the young birds from Telegraph Creek, all in the streaked juvenal plumage, exhibit well defined features of size and color. They are appreciably larger than comparable examples of *sitkensis* and *minor*, and are grayish toned. Juvenals of the small coastal race are much more greenish and olivaceous in general body color.

### ***Loxia curvirostra sitkensis* Grinnell. Sitka Crossbill**

On Sergief Island, during August and September, a few red crossbills were seen at various times. On August 28 an adult female was collected (no. 39875). This bird was evidently incubating a set of eggs, judging from the bare breast and the condition of the oviduct. It seems curious that nesting should have been going on at that season, when we had taken full-grown juvenals of *bendirei* at Telegraph Creek in June.

### ***Loxia leucoptera* Gmelin. White-winged Crossbill**

First positively identified at Glenora, July 4, and near Telegraph Creek, July 5, though small flocks had been seen several days before that were suspected to be this species. During the first three weeks in July flocks were seen daily, in rapidly increasing numbers. Then,

at Doch-da-on Creek, July 21, a male bird was shot that was one of a pair. Several pairs were seen there subsequently, and the flocks appeared to be breaking up. At Flood Glacier, July 26 to August 8, the species was present in great numbers, and breeding. No nests were discovered, but several females were shot that had laid parts of their sets. The birds were fairly numerous at Great Glacier, August 9 to 16, several were seen about the custom house at the boundary, August 16, and they were frequently observed at Sergief Island up to the time of our departure.

It was a surprise to me to find this crossbill nesting so late in the summer. That this is not the invariable custom of the species is shown by Grinnell's (1900, p. 45) account of their habits in the Kotzebue Sound region, where eggs were found in May. Their actions in the Stikine country may have been influenced by food conditions, for in 1919 throughout the region there was a tremendous crop of spruce cones, which were ripening at the time of the appearance of these birds.

At Glenora the crossbills were feeding on the seed pods of the cottonwoods, as they were also in some degree at Doch-da-on Creek, but farther down the river, and a little later in the season, the spruce cones had their undivided attention.

The song of the white-winged crossbill was one of the most notable features of the bird life of the Stikine Valley. As the flocks broke up, the male birds sang more and more. During our stay at Flood Glacier they were at the height of their efforts, and the music was in our ears at all times. It was a continuous, rollicking, trilling song, lasting for minutes at a time without cessation, and loud enough to be heard several hundred yards. The singer was usually on some high perch, preferably the dead top of a tall spruce; frequently he would fling himself into the air on wide extended, slow beating wings, singing as he went, flying sixty or seventy yards, perhaps, to another perch. The song is somewhat suggestive of that of a caged canary; we also found it reminiscent of that of the California house finch (*Carpodacus mexicanus frontalis*). The song-flight especially is suggestive of a similar spring performance of the house finch.

Nine specimens collected (nos. 39880-39888), four adult males and five adult females, two from Glenora, two from Doch-da-on Creek, and five from Flood Glacier.

***Leucosticte tephrocotis littoralis* Baird. Hepburn Rosy Finch**

Met with at but one locality, on the mountain tops above Doch-da-on Creek. We made two trips to the higher ridges above timber line, and saw rosy finches in some numbers each time. They appeared in view soon after we emerged from the upper edge of the forest (about 3500 feet) and they evidently inhabited all of the open country from there on upward. Upon our first visit to their territory (July 11) not many of the birds were seen, and they were mostly drifting about through the air by twos and threes, as horned larks do at times.

The next time we climbed the mountain, on July 23, we found them in much greater numbers. Just at the upper edge of the timber a flock of twenty or thirty was encountered, feeding in tall dry grass that had grown up in an area previously swept by fire. Many dead trees stood on this slope, and the rosy finches when startled flew to the tree tops. This entire flock was of adult birds; two males were collected, and my impression was that they were all males, beginning to flock together after the nesting season. A little farther on females and young were found, mostly near extensive snow banks. The young were all in juvenal plumage and were not quite full grown; that is, wing and tail feathers had not reached their full length. The old birds were assiduously feeding the young, and in the pursuit of this duty we several times saw them fly into the air to capture flying insects, which were then carried to the waiting offspring.

Twenty-one specimens collected, all taken July 23 (nos. 39889-39909), four adult males, seven adult females, six juvenal males, three juvenal females, and one juvenal with sex not ascertained.

The adults are all in worn breeding plumage, though the feathers are not so ragged as might be expected. Some are just beginning the annual molt. The main plumage variation concerns the gray coloration on chin and throat. In some the brown of the breast extends well up on the chin, in others there are scattered gray feathers extending downward from the throat on to the breast. The juvenals, as compared with the similar stage in *Leucosticte tephrocotis dawsoni* from the Sierras of California, are noticeably dark colored throughout.

The gullets and stomachs were preserved of sixteen birds, all that contained any food. From these it is evident that insects form a large part of the diet of both old and young during the summer months. Stomach contents (determined at the United States Biological Survey) in detail are as follows:

No. 39889, adult male. Contents: 1 Elaterid, 1 Ichneumonine, 1 Tipulid, fragments of many plant lice, about 370 seeds of *Potentilla*, sp., at least 58 seeds of Caryophyllaceae, about 200 small seeds (probably *Mollugo*), 1 *Polygonum viviparum*, some vegetable debris.

No. 39891, juvenal male. Contents: 2 *Lina interruptum*, 1 Scolytid, 1 Lampyrid, 1 Elaterid, 1 Anisotoma, sp., 1 small Jassid, bits of a caterpillar, fragment of a spider, several Tipulids, 6 Empids, 1 Anthomyiid, 1 Syrphid, about 30 Aphids, 1 *Camponotus*, sp., 1 *Leptothorax*, sp., about 750 Caryophyllaceae seeds (near *Silene*), about 152 *Polygonum viviparum* (small bulblets), and about 54 seeds of *Potentilla*, sp.

No. 39892, juvenal male. Contents: 1 plant louse, Hymenoptera fragments (including 1 Myrmicinae), Dipterous remains, including Tipulids, 1 Anthomyiid, 1 Mycetophilid, 9 Caryophyllaceae, several bulblets of *Polygonum viviparum*.

No. 39893, juvenal female. Contents: fragments of a Tipulid, a few Aphids, 216 stamens of *Pentstemon*, sp., 1 seed of *Potentilla*, sp., and 17 Caryophyllaceae (near *Silene*).

No. 39894, juvenal male. Contents: 1 Elaterid, 1 *Syneta*, sp., 1 *Haltica*, sp., 2 Scolytids, bits of a weevil, 1 *Pytho*, sp., 2 Aphids, fragments of Diptera, 33 *Potentilla*, sp., 22 seeds of *Carex*, sp., 1 *Arenetra*, 2 Ichneumonids, 1 *Protopanteles*, 1 Pteromalid, 3 Belytids, 1 *Aphidius*, 1 *Nematine*, 1 *Emphytina canadensis*, and 1 *Amauronematus*.

No. 39896, juvenal male. Contents: 1 *Megastigmus*, sp., 3 *Leptothorax*, sp., about 150 Aphids, 4 Empids, 1 *Plecopterion*, 18 stamens of *Pentstemon*, sp., 21 seeds of Caryophyllaceae (near *Silene*), and 20 small Dicotyledons.

No. 39897, juvenal, sex not determined. Contents: 1 Neuropterous insect, 214 stamens of *Pentstemon*, sp., 1 *Potentilla*, sp., 15 Caryophyllaceae (near *Silene*).

No. 39898, juvenal male. Contents: fragments of Diptera (including Tipulidae), 25 seeds of Caryophyllaceae (near *Silene*), about 24 stamens of *Pentstemon*, sp., 2 seeds of *Potentilla*, sp., and 1 small sedge seed.

No. 39899, juvenal female. Contents: 1 *Emphytina canadensis*, 3 Tipulids, several Aphids (including 2 *Psylla*, sp.), 19 Caryophyllaceae (near *Silene*), and 81 immature bulblets of *Polygonum viviparum*.

No. 39900, adult female. Contents: fragments of an Acridid nymph and about 300 seeds of Cyperaceae (probably *Carex*).

No. 39901, adult male. Contents: bits of a Carabid, 1 Bythoscopinæ, about 40 Aphids, Tipulid remains, 2 Acalyptrate flies, 3 Tenthredinids (*Pachynmatus*), 1 Pteromalid, 1 Camponotus, 1 *Diaeretus rapae*, 1 *Ichneutes reunitor*, 1 Braconid, and 1 *Diplazon laetatorius*, 2 small bulblets of *Polygonum viviparum*, 18 Caryophyllaceæ (near *Silene*), and 8 small Dicotyledonous seeds.

No. 39903, adult male. Contents: 1 Scarabeid (probably *Ataenius*), 1 *Camponotus*, sp., 1 *Stenomacrus*, 1 *Diaeretus rapae*, 1 Ephydrid, about 25 Aphids, 1 caterpillar, about 120 seeds of *Potentilla*, 7 sedge seeds, 10 stamens of *Pentstemon*, sp., 26 *Vaccinium*, sp., 2 seeds near *Mollugo*, sp., 8 Caryophyllaceæ seeds (near *Silene*, sp.), and 3 small Dicotyledonous seeds.

No. 39904, adult female. Contents: 1 Pteromalid, 1 fly (Empidæ), about 58 plant lice, 1 insect pupa (probably Lepidopterous), 1 immature bulblet of *Polygonum viviparum*.

No. 39905, adult female. Contents: 1 nymph of *Geocoris*, sp., head of a Microlepidoptera, 2 Lycosids, 2 Tipulids, 3 moths, 2 seeds of Cyperaceæ.

No. 39906, adult female. Contents: fragments of 2 *Lina interruptum*, 1 Acalyptrate fly, 1 *Psylla*, sp., about 75 Aphids, bits of a spider.

No. 39907, adult male. Contents: 3 moths, 1 Tipulid, 225 seeds of *Carex*, sp.

TABLE VII

Percentage of animal and vegetable matter in stomachs of *Leucosticte tephrocotis littoralis*

No.	Sex	Age	Percentage of animal matter	Percentage of vegetable matter	Percentage of gravel, etc.
39891		juv.	46	54	...
39892	♂	juv.	80	20	...
39893	♀	juv.	2	98	...
39894	♂	juv.	88	12	18
39896	♂	juv.	84	16	..
39897	...	juv.	1	99	trace
39898	♂	juv.	40	60	....
39899	♀	juv.	50	50	....
39899	♂	ad.	45	55	trace
39900	♀	ad.	....	100	....
39901	♂	ad.	95	5	....
39903	♂	ad.	60	40	...
39904	♀	ad.	99	1	...
39905	♀	ad.	99	1	....
39906	♀	ad.	100	....	....
39907	♂	ad.	55	45	....
Average			59	41	



TABLE VIII

Measurements in millimeters of adults of *Leucosticte tephrocotis littoralis*

All from mountains above Doch-da-on Creek, B. C., July 23, 1919

		Wing	Tail	Culmen	Depth of bill	Tarsus
39889	♂	104.	69.	11.5	7.5	20.
39903	♂	103.	68.	12.	8.	19.5
39901	♂	100.	65.	10.5	7.5	18.
39907	♂	103.	69.	11.	8.	20.5
39900	♀	95.	61.	11.5	7.5	19.5
39902	♀	98.	64.	11.	8.	18.5
39904	♀	96.5	64.5	11.	7.5	19.
39905	♀	96.	61.	11.5	7.5	19.
39906	♀	101.5	65.	11.5	8.	19.
39908	♀	97.	61.	11.2	8.	19.
39909	♀	93.	59.	11.8	7.5	19.

***Spinus pinus pinus* (Wilson).** Pine Siskin

Fairly common throughout the whole region traversed, and seen in flocks during the entire nesting season. At Telegraph Creek birds were seen carrying building material during the first week of June, and on June 20 a set of three eggs was taken. The extensive open fields at Glenora were thickly grown up with dandelions when we arrived there at the end of June, and the siskins were present in large flocks, feeding upon the dandelion seeds. At the same place they were seen about the log cabins picking at the plaster between the logs.

At Doch-da-on Creek, at Flood Glacier, and at Great Glacier, siskins were encountered daily, usually in small flocks. During our brief stop at the boundary, August 16, the pine siskin was one of the few species of birds noted. It was present at Sergief Island, but not numerous.

The one nest found (no. 1810), taken near Telegraph Creek, was in a small lodgepole pine in very open woods, the same tract where the Bohemian waxwings were nesting. It was about six feet from the ground, resting against the main stem and well-nigh hidden by the clusters of needles upon the small supporting branches. The structure is well built and compact, composed outwardly of small twigs and the white down from the fireweed; the lining, of grasses and some moss from the trees. The outside diameter of the nest is about 90 millimeters, depth, about 60; inside diameter, about 60, inside depth, 25 millimeters.

The eggs, three in number, were slightly incubated. They are a little paler than lichen green; in two cases there is a wreath of reddish

spots at the large end, in the third egg this wreath is reduced to a few minute spots. Seven specimens of this bird were collected, all adults (nos. 39910-39916). Four are from the vicinity of Telegraph Creek, one from Glenora, one from Doch-da-on Creek, and one from Flood Glacier. These birds are grayer in general coloration than most of the specimens in a comparable series from the Alaskan coast, but there are individuals in the coastal series not to be distinguished from those taken in the interior.

***Calcarius lapponicus alascensis* Ridgway. Alaska Longspur**

Seen only at Sergief Island, where it occurs merely as a migrant. First noted on September 3, and the two following days, our last in the field, small flocks appeared from time to time. All the birds seen were flying, passing overhead in a southerly direction.

***Passerculus sandwichensis savanna* (Wilson). Savannah Sparrow**

Seen only at Sergief Island. Upon our arrival there, August 17, Savannah sparrows were present though not abundant. Some days later they increased greatly in numbers, and at the end of August were found everywhere over the marshes. They kept mostly to the flooded grass lands, a much wetter habitat than that favored by the song and Forbush sparrows, also abundant at the same station.

Nine specimens were collected (nos. 39921-39929). The discovery that the subspecies *alaudinus* breeds but a short distance inland (see p. 240) was an incentive toward an accurate determination of the status of the quite distinct coastal subspecies. This coastal subspecies, formerly lumped with *Passerculus s. alaudinus*, has been latterly referred to *savanna*, of eastern North America, to which it bears a close resemblance (see Grinnell, 1909b, p. 227; Swarth, 1911, p. 85). There is no doubt, however, that the form occurring on the coast of southeastern Alaska is entirely cut off from the habitat of the eastern *savanna* by the intervention of the range of *alaudinus*. It is a local race that is probably confined almost entirely to the Alaskan coast, and with but a limited migration, one extending usually not much farther southward than the Puget Sound region. There is apparently no place where it approaches at all closely the habitat of the eastern *savanna*. A thousand miles or more must intervene. Nevertheless, despite the wide difference in habitat, birds from the two regions are so much alike in appearance that I am unable to detect any character whereby they

can be distinguished. It is a puzzle just what should be the proper nomenclatural treatment of these forms. In all probability the relationships of the two are not particularly close. It seems likely that there is continuous distribution of Savannah sparrows along the Pacific coast of North America, with probable intergradation between the Alaska forms and the darker colored California subspecies, and this, I believe, is the line of closest affinities.

I am willing to admit geographical distribution as one of the characters of a form, but to make distribution the *sole* character is farther than I care to go. So, on the ground of external resemblance, the Savannah sparrow of the coast of southeastern Alaska is here recorded as *P. s. savanna*, but with no belief that it is genetically the same as the eastern subspecies bearing that name. The case is closely paralleled by the red crossbills (*Loxia curvirostra sitkensis* and *L. c. minor*).

***Passerculus sandwichensis alaudinus* Bonaparte. Western Savannah Sparrow**

Found at but one or two points in the upper Stikine Valley. On May 31, at the Junction, the mangled remains of one were found in a mousetrap, our first intimation of the arrival of the species. Several were seen at the Summit, June 4; a male bird collected at that time appeared to be breeding. At Glenora there were a few scattered through the weed-grown fields, and they were evidently nesting there. The males were uttering their wheezy trills from the tops of low bushes or from fences or stakes, and could be found at about the same spots day after day. Females collected were evidently incubating.

No Savannah sparrows were seen farther down the river than Glenora until we reached the coast, the habitat of another subspecies. There are not many places in the Telegraph Creek region that afford the needed surroundings for this bird, for extensive clearings supplying the open ground they favor are found in but few places. Where we saw them at the Summit is at about the upper limit of timber, and it may be that the species occurs commonly in such a habitat. We saw no Savannah sparrows, however, on the mountain top above Dochda-on Creek.

Four specimens collected (nos. 39917-39920), two adult males and two adult females. These are obviously different from *P. s. savanna* of the coastal region. Compared with the latter the Telegraph Creek birds are of grayer coloration, have a longer wing, and a more slender

bill. They are apparently the same as the form occurring in the uplands of west central and southern California in winter, to which the name *Passerculus s. alaudinus* has been applied (see Palmer, 1918, p. 123).

***Zonotrichia leucophrys gambeli* (Nuttall). Gambel Sparrow**

Fairly common in the river valley at Telegraph Creek. This may be taken as near the western limit of the summer habitat of this subspecies in this region, for although the birds were numerous in and about the town of Telegraph Creek, they became notably scarce a very few miles farther down the river. In our two weeks' collecting at Glenora but one bird was seen, and none was observed farther down stream, with the exception of one at Sergief Island after the fall migration had begun.

Several nests were found near Telegraph Creek. On June 6 a bird was seen carrying building material. On June 11 and 14 three nests were discovered on certain slopes near Sawmill Lake where most of the timber had been removed. They were much alike in site and construction, placed on or near the ground under the piles of brush left from the trees that had been cut away. Each contained newly hatched young, three and four in number. The parent bird, when frightened by our near approach, did not fly direct from the nest, but skulked through the brush for ten or twelve yards before flying.

Two specimens collected, an adult male at Telegraph Creek (no. 39930), and an immature female (no. 39931), taken at Sergief Island, September 4, the only one seen at that point.

***Zonotrichia coronata* (Pallas). Golden-crowned Sparrow**

The closely related golden-crowned and Gambel sparrows occupied different local habitats, although both occurred commonly in the same general region. Presumably Telegraph Creek is near the eastern limit of the habitat of *coronata*, just as it is at the western confines of the summer home of *gambeli*. Their segregation apparently is due to zonal limitations. The golden-crowned sparrow is a bird of a higher zone than the Gambel sparrow, consequently, in the Stikine region, confined to higher altitudes. No *coronata* was seen near the town of Telegraph Creek (altitude 540 feet), where *gambeli* was common, but on the trail to the Summit (twelve miles north of town and at about 2700 feet altitude) they appeared in some numbers where the timber

became dwarfed and scattered. The birds were in full song during the first week in June. A female shot June 5 contained eggs just beginning to form.

As we went down stream the species was seen nowhere in the bottom lands, but it was encountered once more on the mountains above Doch-da-on Creek. There we found the birds at timber line, on July 11 and again on July 23. Dixon found them amid similar surroundings on a mountain a few miles north of Doch-da-on Creek ("Kirk's Mountain") on July 16, and saw two bobtailed young. At these several points they were at the extreme upper limit of timber, at about 3000 to 4000 feet altitude, and mostly in dense thickets of prostrate "mountain balsam" (*Abies lasiocarpa*). From these shelters could be heard a sharp, far-reaching *chip*, a note that was difficult to locate, but was finally traced to the golden-crowned sparrow. The birds were undoubtedly nesting in the balsam thickets. Probably they had young at the time, but careful search failed to reveal any except the two that Dixon saw while stalking a mountain goat. On July 23 the birds were noticeably fewer in numbers than they had been on our first visit to their habitat on July 11, and it seemed probable that they had already begun to leave.

It seems likely that the timber-line habitat of *coronata* extends westward nearly or quite to the Alaskan coast. With field glasses we were able to see, at various points down the Stikine, ridges and mountain tops that appeared to be much like the high altitudes we reached from the upper river. Near the coast, however, the mountains are in most places extremely hard to ascend, and the fauna of their summits is as yet unknown. The golden-crowned sparrow is a species of high Hudsonian and Alpine-Arctic. It is a bird of the coastal region rather than of the interior, but, except at the northern end of its habitat, is apparently restricted to high altitudes during the summer months.

During the migrations this sparrow is abundant at sea level. At Sergief Island the first one appeared on September 1. The next day the species was present in considerable numbers. Seven specimens collected (nos. 39932-39938), three at the Summit, June 4 and 5, one on the mountain above Doch-da-on Creek, July 23, and three on Sergief Island, September 1 to 5.

***Spizella monticola ochracea* Brewster. Western Tree Sparrow**

Seen at but one place. At the Summit, some twelve miles north of Telegraph Creek and at about 2600 feet elevation, several pairs of western tree sparrows were seen on May 29, June 4 and 5, evidently

nesting there. The birds were seen feeding on the ground at the edges of marshy meadows, usually near the shelter of thickets of scrubby willow brush. The three specimens collected (nos. 39939-39941) are not to be distinguished from examples at hand from the Yukon and Kotzebue Sound regions, Alaska. I have seen a specimen collected by E. P. Walker at Wrangell, January 16, 1919. This capture may indicate the occasional passage of the species down the Stikine Valley.

***Spizella passerina passerina*** (Bechstein). Eastern Chipping Sparrow

Abundant at low altitudes in the upper Stikine Valley. Many seen near Telegraph Creek, in sparsely wooded sections, the males frequently singing from some low perch. Two nests were found here, on June 19 and 24. Each was in a lodgepole pine sapling, some ten feet from the ground, and in each case the tree was too slender to be climbed. The species was likewise abundant at Glenora and at Doch-da-on Creek. It was not seen farther down the river. Seven specimens collected, all adults (nos. 39942-39948). These, and others from northern British Columbia, in color and measurements are much nearer to eastern *passerina* than to typical *arizonae* from Arizona.

***Junco hyemalis connectens*** Coues. Cassiar Junco

We collected forty-four specimens of this junco, as follows: vicinity of Telegraph Creek (between that point and the Summit), twenty-eight (fourteen adult males, twelve adult females, and two juvenals); Glenora, seven (one adult male, three adult females, and three juvenals); Doch-da-on Creek, three (one adult male, two juvenals); Flood Glacier, six adult males. (Museum nos. 39949-39988, 39990, 39993, 39998, 39999.)

The systematic status of the junco of the Stikine region is a matter of more than ordinary interest to both the taxonomist and the student of geographic distribution and evolution. Any treatment accorded this form would doubtless arouse criticism from some direction, but it seems to me desirable that the race be accorded formal subspecific status. This junco is, in my opinion, a "good subspecies," a geographic race, in the sense that the birds over a certain area (of undetermined extent but undoubtedly a considerable stretch of country) exhibit a combination of characters distinguishing them from other described forms, and they remain true to these peculiarities within as close limits as do most recognized subspecies.

The outstanding characteristics of the Cassiar junco are as follows: Most nearly related to *Junco hyemalis hyemalis*. Males of the two subspecies are very closely similar, differing in minor particulars as detailed beyond. The average female of *Junco h. connectens* is quite unlike female *hyemalis*. It has ordinarily more or less pink on the sides and brown on the back; the head is of a darker color and is sharply cut off from the brownish back above and from the pink sides and white belly below. The general appearance of the female is like that of the female *Junco oreganus shufeldti*, from which it differs in having usually less brown on the back and less pink on the sides.

Now, as regards the name to be used for this form. My first impression was that here was an undescribed subspecies, a "new" race that required a new name. It was evident, however, that this was a migratory form, and that individuals must have been collected in their more southern winter home, even though the summer habitat had not heretofore been explored. There was at least a chance that a winter-taken specimen had served as the basis of a description at some time. A search through junco synonymy disclosed one name that seemed to require investigation, *Junco hiemalis connectens* Coues (1884, p. 378), which has been applied in various ways. Two specimens, the one upon which this name was based, together with another like it, females collected at Colorado Springs, Colorado, April 26 and 27, were described in some detail by Allen and Brewster (1883, p. 189) under the name *Junco hiemalis oregonus*. They are there considered as "intermediates between *hiemalis* and *oregonus*." Ridgway (1901, p. 276) lists Coues' *connectens* as a probable hybrid under the heading "*Junco hyemalis* x *Junco oreganus shufeldti*." In a footnote (*loc. cit.*) he makes the following comment:

This type specimen, which I have carefully examined and compared, is No. 7046 of Mr. Brewster's collection, and was taken by Mr. Brewster at Colorado Springs April 26, 1882. It is very nearly typical of *J. hyemalis*, with sides only slightly tinged with cinnamonaceous and the back slightly brownish. It may be a young female, of the preceding year, of *J. hyemalis*; at any rate it has nothing to do with the form of *J. oreganus* (*J. o. shufeldti*), to which the name *connectens* was unadvisedly applied by action of the A. O. U. Committee in 1896.

Dwight (1918, p. 289) remarks as follows:

This is perhaps an appropriate place to discuss briefly and to dispose of the "*Junco hyemalis connectens*" of Coues. The original description (1884, Key North Amer. Birds, 2d ed., p. 378) is a curious mixture of fact and fancy but, fortunately, the type is extant in the collection of Mr. Wm. Brewster (No. 7046,

♀, April 26, 1882, Colorado Springs, Colo.). I have examined it and, as correctly stated by Mr. Ridgway (1901, *Birds North and Middle Amer.*, Pt. 1, p. 276, footnote), it is clearly a specimen of *hyemalis*, and shows the characters common to sex and season.

The American Ornithologists' Union Committee (1897, p. 128; 1910, p. 266) follows Coues (1897, p. 94) in applying the name *connectens* to the form named *Junco hyemalis shufeldti* by Coale (1887, p. 330) and re-named (as I believe) *Junco oregonus couesi* by Dwight (1918, p. 291).

It is thus seen that the two men (Ridgway and Dwight) who have most carefully studied the genus *Junco* in recent years unite in the belief that *connectens* is not a recognizable form. It is after some hesitation that I offer a contrary opinion, but I believe that the new material at my disposal justifies my view. As to the treatment of the name *connectens* by the A. O. U. Committee, I am of the same opinion as Ridgway, that it is wrongly applied in the *Check-List* to the form that should be called *Junco oregonus shufeldti* Coale. The description by Allen and Brewster (1883, p. 189) of the Colorado bird that served later as the type of *connectens*, obviously a migrant or winter visitant at the point of capture, fitted so nearly my specimens from the Stikine region as to lead me to suspect them to be the same. This bird, as part of the Brewster collection, is now in the collection of the Museum of Comparative Zoology, at Cambridge. I have not examined it myself, but at the kind suggestion of Mr. Outram Bangs I sent him a selected series of the Stikine birds for comparison with the type of *connectens*, and, incidentally, with any other pertinent material. He remarks upon them as follows:

I have compared the skins most carefully with our very large series of eastern birds. . . . The very black, sharply marked off top of the head in your male birds I cannot match. The type of *J. connectens* Coues is a female taken at Colorado Springs, Colorado, Apr. 26, 1882. It is a counterpart of your no. 10945 (*Mus. Vert. Zool.*, no. 39957). Indeed you would have difficulty in telling the two apart, except that the type of *connectens* is, although taken at an earlier date, in a little more worn plumage. I can't find spring females from the east just like these, but on the other hand, autumnal females much resembling them (probably young birds of the year?) are common in our series.

For comparison with *hyemalis*, the form to which I believe *connectens* is most nearly related, I have had an abundance of non-breeding birds from various places in the eastern United States, and a few from western points. No series of breeding birds of the eastern *Junco h. hyemalis* is available.



The adult male of *connectens* is very similar to *hyemalis*. At first glance, in the field, there was no doubt in my mind that *hyemalis* was the form encountered. Comparison with eastern birds, however, shows certain appreciable differences. *Connectens* is darker colored throughout, and, compared with the more uniformly slaty hued *hyemalis*, is seen to possess a blackish head, quite sharply defined at a line above the shoulders. Beneath, in *connectens*, the outline of the black breast is convex against the white belly, forming a sharp angle where it joins the gray sides. In eastern *hyemalis* the slaty breast and sides usually form a concave outline against the white belly. In most cases, a specimen of *connectens* viewed laterally is seen to possess a black head pattern above and below, just about as in *Junco oreganus*, though, of course, more obscurely indicated than in that species. These distinctions, as just detailed, would not amount to very much in a single bird, perhaps, but viewed in mass effect, with specimens of the three forms arranged in parallel rows, the differences are readily noticeable. The black-headed appearance of the male is a feature that is conspicuous in the live bird.

The female of *connectens* is, as a rule, more nearly like the female of a subspecies of the black-headed *Junco oreganus* group than like female *hyemalis*. The sides are more or less tinged with pink (often quite strongly so), and the back with brownish. The blackish head is sharply defined against the back and against the pink sides and white belly. Two among the fifteen females from Telegraph Creek and Glenora have no pink on the sides, though with brown on the back. These two birds are most nearly like *hyemalis*. Of the others it is safe to say that not one would be ascribed to *hyemalis* if taken in its winter home, with nothing but the appearance of the bird as a guide to its specific identity. There are certain winter specimens of *Junco oreganus shufeldti* at hand from southern Arizona, that, so far as color and markings are concerned, are indistinguishable from some Stikine River females. Arizona specimens of *shufeldti*, however, are distinctly longer winged.

Thus there is here a race in which the male bears a strong resemblance to one specific group (*Junco hyemalis*), and the female to another (*Junco oreganus*), this race occurring at a point where the boundaries of the two species mentioned come close together. Different authorities take different views regarding the relationship of the two forms, *hyemalis* and *oreganus*. In the A. O. U. *Check-List of North American Birds* (1910, p. 266) they are treated as two subspecies of

one species. Ridgway (1901, pp. 278, 283) regards them as specifically distinct, each divided into several subspecies. Dwight (1918, pp. 285, 291) also considers them as two species. Dwight, however, regards as of hybrid origin several forms of *Junco* that are accorded subspecific, or even specific, rank, by Ridgway and others. All "confusing plumages," found in the borderlands where different species of *Junco* come together, he regards as the result of hybridism.

In view of these different opinions, it is of interest to secure specimens and study conditions at places where two distinctly characterized forms meet. The upper Stikine Valley is such a place, and, with these points in mind, the junco of that region received special attention in our field work. Though anticipating some interesting discoveries in the distribution of the forms involved, it could hardly be foreseen that this borderland should be occupied by a race so curiously combining the characters of the eastern *hyemalis* and the western *oreganus*. With the ascertaining of this fact there now remains the proper application of it, and in this I fancy there will be difference of opinion.

First, is the occurrence of birds of this description (in a sense, intermediate between *hyemalis* and *oreganus*) to be taken as indicative of intergradation between the two? Are *hyemalis* and *oreganus* therefore to be regarded as two subspecies of the same species? I think not. There is no adult specimen in the *connectens* series that could for a moment be confused with the coastal junco (*Junco oreganus oreganus*), the subspecies geographically most closely adjacent to the upper Stikine race. There are no doubtful specimens as between these two forms, hence no intergradation. The measurements of *connectens* do not show intergradation between *Junco h. hyemalis* and *Junco o. oreganus* (see table, p. 254). The resemblance of the female *connectens* is toward *Junco o. shufeldti* (= *Junco h. connectens* of the A. O. U. Check-List), a pale colored form of *Junco oreganus* occurring to the southward. There may be intergradation between *connectens* and *shufeldti* farther south in British Columbia, but as yet we do not know that to be the case.

Then, as to the theory of hybridizing, used to a great extent in comparable cases by Dwight in his study of the juncos (1918). Such a decision in the present case (as in certain others so disposed of by Dwight) seems to me to distort the meaning of the word hybrid out of all recognition, and to apply it to facts and conditions it is not commonly called upon to cover. I am willing to admit that a name such as *Junco annectens* Baird may have been applied to an individual bird

actually of hybrid parentage in the usually accepted sense, in that particular case with one parent *Junco caniceps*, the other, *Junco mearnsi*; and I am willing to admit (see *postea*) that individual hybrids may occasionally occur between any species of *Junco* whose ranges adjoin. To consider as hybrids, however, all the birds (juncos in this instance) of a whole region, despite the facts that they comprise the only representative of the species in that region, that they all exhibit the same combination of characters over a wide stretch of country, and that they breed true, that is, transmit these same characters to their young, is an utterly misleading use of the term. The junco of the Stikine River should not be regarded as a hybrid.

As bearing upon the fact that it is the female of *connectens* that shows variation from the *hyemalis* type, attention may be drawn to the following statement by Dwight (*loc. cit.*, p. 289): "The variation in females of the three species [i.e., *hyemalis*, *oreganus*, and *mearnsi*] complicates the question still more, for the average females of the three differ much less from one another than do the males, and the hybrids between them would seem therefore to be much more numerous." I suppose the application of this to the present case (the junco of the Stikine region) would lead to the conclusion that here on a large scale is an example of sex-linked inheritance; that in the hybridization of *hyemalis* and *oreganus* the female offspring only show the *oreganus* characters. That such is not the case is shown by specimens collected at Flood Glacier (described farther on), where the race here designated *connectens* comes into actual contact with *oreganus*.

My own conclusions are as follows: The junco of the Stikine region is a recognizable form, apparently the same to which Coues applied the name *Junco hiemalis connectens*. It is most nearly related to *Junco hyemalis hyemalis*, and may be conceded to exhibit intergradation of a sort, as between *Junco hyemalis* and *Junco oregonus*. That is, the peculiarities of this subspecies undoubtedly have some bearing upon the relationship of those two aggregations of races. The intergradation exhibited, however, is apparently as between the two species *Junco hyemalis* and *Junco oregonus*, rather than between two adjacent subspecies, *Junco hyemalis connectens* and *Junco oregonus oregonus*. It is not of the sort that is usually found between two subspecies of the same species, and for the present it may well be disregarded as a sub-specific criterion. It seems to me that this is a proper place for a somewhat arbitrary division, and that *Junco hyemalis* and *Junco oregonus* should still be regarded as separate specific groups. Then,

as previously shown, the junco of the Stikine region, although in a sense intermediate in appearance between *hyemalis* and *oreganus*, can not properly be considered as an aggregation of hybrid individuals. The only alternative left, therefore, is to consider this form as a distinguishable geographical race of the species it most nearly resembles, and apply a separate name, as I have done.

As we descended the Stikine, leaving the habitat of *connectens* behind and drawing nearer to that of *oreganus*, every effort was made to secure juncos. At Telegraph Creek and Glenora, juncos (*connectens*) were abundant. At Doch-da-on Creek, though in lessened numbers they were still fairly numerous, and all still of the same subspecies. Our next stop was at Flood Glacier, some forty miles down stream and about seventy miles from the coast. There we were in a region where either coast or inland species might occur, and the junco was one of several birds that we searched for especially at that point. Juncos were not numerous, however, and our two weeks of collecting there yielded but fifteen specimens. Of these, eight are adults, six males and two females. The two females are *Junco o. oregonus*, beyond a doubt. Of the male birds, one (no. 39999) is typical *connectens*. It is in extremely worn plumage but is evidently of exactly the same character as Telegraph Creek specimens. One bird (no. 39993), while not an average *connectens* (it shows some rusty on the back), can be matched by one variant taken at Telegraph Creek. Another (no. 39998) is somewhat more reddish on the back, though the sides are slaty. The remaining three adult males (nos. 39987, 39988, 39990), if taken farther south, in their winter home, would undoubtedly be considered as examples of *Junco oregonus shufeldti*. They are shorter winged than Arizona winter specimens of *shufeldti*, but they have the black head (a glossier black above than in *connectens*), brownish back, and pink sides of that race. However, despite their general appearance, I cannot believe that these birds are *shufeldti*. I do not believe it possible for the habitat of that subspecies to extend northward as a tongue inserted between the ranges of *connectens* and *oreganus*. Juncos can not be distributed uninterruptedly from the southward over the glacier covered mountains that constitute so large a part of this intermediate region. Their distribution must lie in narrow ribbons along the river valleys extending from the interior to the coast, such as the Stikine, and the affinities of birds taken at any one point in these valleys must lie with others immediately adjacent, above and below. Therefore, despite the superficial resemblance of these

Flood Glacier juncos to *shufeldti*, I decline to consider them as of that subspecies, or to call them by that name. This despite Dr. Dwight's belief that "we must name a bird by the plumage it is wearing not by the one that it ought to be wearing because it has been captured within the bounds assigned to another geographical race" (1918, p. 294).

Flood Glacier is close to the point where the change in the character of the country takes place, between the humid coast and the arid interior. It is the uppermost point on the river reached by certain coastal species of birds; very few indeed go any farther inland. Not many inland species extend farther down the river. We took here specimens of typical *connectens* and of *oreganus*, besides these intermediates. Forty miles up stream nothing but *connectens* was seen. Thirty miles farther down the river, at Great Glacier, nothing but typical *oreganus*.

In view of these facts it seems to me that these few specimens of indeterminate character, taken practically on the boundary line between the habitats of the two forms, may be regarded as veritable hybrids between the two. They are certainly not indicative of intergradation as it usually appears between closely related subspecies.

The seven juvenals from Flood Glacier naturally offer difficulties in their allocation such as are not encountered in adults. Young of *connectens* taken early in the season in the upper Stikine Valley, compared with the corresponding stage of *oreganus* from the coast, present certain obvious differences. As the juvenal feathers become faded and abraded, however, these distinctions are much less apparent, and the young birds from Flood Glacier had worn the juvenal plumage to the molting time. Those that do show specific peculiarities all lean toward *oreganus*, and one or two, otherwise indeterminable, were taken in company with an adult female *oreganus*. There are available but very few breeding specimens of slate-colored junco from Alaskan points. These specimens on the whole look more like eastern *hyemalis* than like Stikine River *connectens*. The only breeding females, one from Cordova Bay and one from Rapids, Yukon River, are quite unlike any females in the Stikine series.

I have had for examination a series of seventeen adult juncos, eight males and nine females, from the collection of the Provincial Museum, Victoria, British Columbia, taken at Atlin, during June and July, 1914. Atlin is at the northern boundary of British Columbia, about one hundred and fifty miles north of Telegraph Creek. For the

most part these birds are essentially like the Stikine specimens. One male (Prov. Mus., no. 3683) is much paler colored than the others, more of the slaty gray of eastern *hyemalis*, a variation that may be indicative of intergradation with *hyemalis* in Alaska, a little to the northward. One female of the lot (Prov. Mus. no. 3698, Wilson Creek, Atlin, B. C., June 29, 1914) is so very different in appearance from the rest of the series as to suggest its belonging to another species. It is appreciably larger than the others, actually so in length of wing and tail, and to all appearances in bulk also, as well as can be judged from prepared skins. It is faintly brownish on the back, and with a suggestion of pink on the sides. This bird may, perhaps, be an example of *montanus*, which has been recorded as occurring at Alaskan points not very far distant.

Altogether, the scanty material from Alaska, together with the British Columbian series, points to the restriction of the race *connectens* to a region mostly south of Alaska, and probably almost entirely in British Columbia. In this connection, attention should be drawn to a record by Bishop (1900a, p. 86) of the occurrence of "*Junco hyemalis connectens*, Shufeldt Junco," at White Pass City and Glacier, Alaska, a record that may, perhaps, pertain to *connectens* as here regarded. Osgood (1909b, p. 41) records *Junco hyemalis montanus* from points on the upper Yukon: "An adult female having vinaceous sides and pronounced of this form by Mr. Ridgway was collected by Hollister at Circle July 7. . . . Also a specimen collected by myself near Charlie Creek in 1899 appears to be of this form."

When we arrived at Telegraph Creek, May 23, juncos were abundant and in pairs; evidently nesting was well under way. The male birds at that time were fond of perching on some elevated position, a telegraph pole or a house in town, a dead tree top out in the woods, where, over and over again, they gave utterance to a brief, monotonous trill, hardly long enough or loud enough to merit being termed a song. The first nest was found on June 4, about midway between Telegraph Creek and the Summit, a region in which there was still much snow. This nest was placed in an overhung crevice in the dirt wall bordering the trail, and was discovered through the brooding bird's sudden departure. It contained four eggs with incubation just begun (see fig. Z). From then on, nests were found at intervals up to July 5. On that date two were discovered at Glenora, one with four fresh eggs, one with four young about five days old.

All nests discovered were on the ground, but in a variety of situations. Some were in the shelter of a bank or stump, others on open, level ground with little or no concealment. Five nests with sets of eggs were preserved (nos. 1811-1815), four sets of four eggs each, one of five. The nests are all much alike in structure, rather flimsily built, mainly of rather fine dry grass or weed stems, with occasionally some shreds of bark or coarser twigs or straws on the outside, and with finer grass or hair for lining.

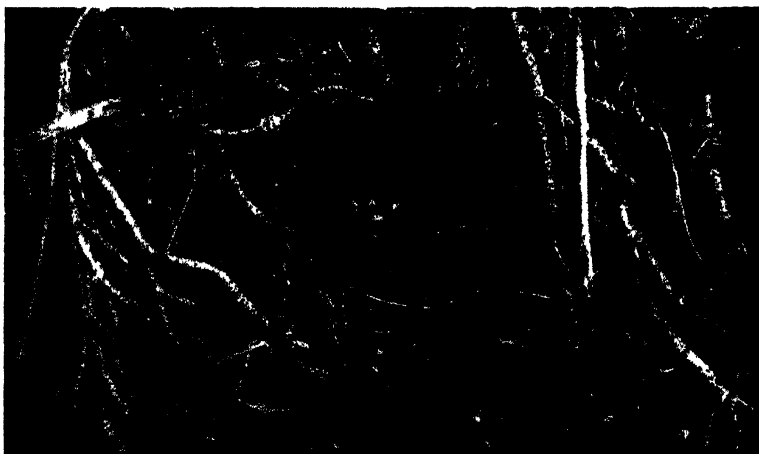


Fig. Z. Nest of the Cassiar junco (*Junco hyemalis connectens*), placed under a fallen tree at the side of a trail. Photograph taken near the Junction, June 6, 1919.

The first young out of the nest was taken on June 14, hardly able to fly. Shortly after young birds began to appear in considerable numbers. Up to the third week in July they were still in the streaked plumage throughout, the post-juvenal molt had not yet begun; shortly after that time we left the territory of this subspecies, so that no specimens in autumnal plumage were collected.

This junco is mainly a bird of the valleys, mostly in rather open woods. A few were seen well up in the mountains, not in the dense spruce forests of the middle heights, but at the upper edge of the timber, where the trees were more scattered and of smaller size. This was at about 4000 feet elevation.

The male junco was sometimes seen making a display of his plumage. The tail was widely spread, so as to expose the white outer feathers, about the only sharply contrasting feature of the junco's

plumage. This was done, not on the ground, but up in the shrubbery; the tail was held stiffly spread and pointed straight downward, while the bird hopped from branch to branch about the female.

Young birds, just out of the nest, were several times found infested with parasitic larvae. The first bird in this condition was collected near Telegraph Creek, June 15. On picking it up after shooting it, a maggot dropped to the ground, and I noticed then a bare spot on the bird's head with a small hole where the larva had been attached. Upon skinning it, two more larvae were found, between the skin and skull, surrounded by a mass of yellow serum. Later on other young juncos were taken similarly afflicted, with the larvae always on the top of the head. The larvae were white in color, seven millimeters long and about three in diameter.

### ***Junco oreganus oreganus* (J. K. Townsend). Oregon Junco**

Twenty-seven specimens referable to this subspecies were collected at three different points, as follows: Flood Glacier, two adult females, four juvenal males, three juvenal females; Great Glacier, one adult male, one adult female, seven juvenal males, two juvenal females, one juvenal, sex not ascertained; Sergief Island, three males and three females, all immature birds in freshly acquired first winter plumage. (Mus. Vert. Zool. nos. 39989, 39991, 39992, 39994-39997, 40000-40019).

Specimens of *oreganus* in juvenal plumage from the coast of Alaska, compared with the same stage of *connectens* from the upper Stikine Valley, are much more buffy beneath and more reddish dorsally; the red dorsal patch of *oreganus* is clearly indicated in the young. Young *oreganus* is a ruddy appearing bird, young *connectens*, grayish. While these differences are apparent in fresh plumage, they are not so obvious when the feathers become worn. The young birds from Flood Glacier, at about the dividing line between the ranges of *oreganus* and *connectens*, are ready to discard the juvenal plumage, and in some specimens it is not possible to tell to which species they belong. However, those which do show specific peculiarities are apparently *oreganus*. Two young males, beginning the post-juvenal molt, are acquiring pink sides, and in one of them the new feathers on the head are distinctly blacker than in *connectens*. Young females, undeterminable in appearance, were taken in company with an adult female *oreganus*. For these several reasons I have assigned the entire series of streaked plumaged young from Flood Glacier to *oreganus*.



TABLE IX

Measurements in millimeters (average, minimum and maximum) of *Junco hyemalis hyemalis*, *Junco hyemalis connectens*, *Junco oregonus oregonus*, and *Junco oregonus shufeldti*

	Wing	Tail	Culmen	Depth of bill	Tarsus
<i>Junco h. hyemalis</i>					
10 males <sup>1</sup>	76.8 (74.0-80.0)	66.3 (63.5-70.0)	10.0	6.2 (6.0-6.5)	21.0 (19.8-21.5)
<i>Junco h. connectens</i>					
10 males <sup>2</sup>	78.8 (77.0-80.0)	68.2 (66.0-70.0)	10.0 ( 9.8-10.2)	6.0	21.0
<i>Junco o. oregonus</i>					
10 males <sup>3</sup>	74.3 (70.5-77.0)	64.3 (60.0-67.0)	10.4 ( 9.5-11.0)	6.0	20.9 (20.0-22.0)
<i>Junco o. shufeldti</i>					
10 males <sup>4</sup>	77.5 (76.0-79.0)	68.1 (66.0-70.0)	10.1 (10.0-10.5)	6.2 (6.0-6.5)	20.5 (20.0-21.5)
<i>Junco h. hyemalis</i>					
10 females <sup>5</sup>	71.6 (70.0-74.0)	62.3 (59.0-66.0)	9.6 ( 9.0-10.2)	6.0 (5.8-6.2)	20.6 (20.0-21.5)
<i>Junco h. connectens</i>					
10 females <sup>6</sup>	72.6 (70.5-74.5)	63.5 (62.0-65.0)	10.0 ( 9.8-10.5)	6.1 (6.0-6.5)	20.5 (20.0-21.0)
<i>Junco o. oregonus</i>					
10 females <sup>7</sup>	70.7 (68.5-73.0)	61.6 (58.0-64.0)	10.1 (10.0-10.5)	6.0	20.4 (20.0-21.0)
<i>Junco o. shufeldti</i>					
10 females <sup>8</sup>	74.6 (72.0-76.0)	65.5 (60.0-69.0)	9.9 ( 9.5-10.0)	6.0 (5.5-6.5)	20.4 (20.0-21.0)

<sup>1</sup>Connecticut, 2; New York, 1; New Jersey, 1; Virginia, 4; Indiana, 1; Iowa, 1.

<sup>2</sup>Telegraph Creek, British Columbia.

<sup>3</sup>Alaska: Admiralty Island, 1; Kuiu Island, 1; Warren Island, 1; Dall Island, 2; Revillagigedo Island, 1; Wrangell Island, 4.

<sup>4</sup>Hazelton, British Columbia, 5; Huachuca Mountains, Arizona, 2; Chiricahua Mountains, Arizona, 3.

<sup>5</sup>Connecticut, 2; New York, 1; New Jersey, 1; District of Columbia, 1; Illinois, 3; Minnesota, 2.

<sup>6</sup>Alaska: Mouth of Taku River, 4; Baranof Island, 2; Hecla Island, 1; Sergief Island, 2; Wrangell Island, 1.

<sup>7</sup>Hazelton, British Columbia, 1; Huachuca Mountains, Arizona, 3; Chiricahua Mountains, Arizona, 6.

Young birds taken a week or two later at Great Glacier are in most cases well advanced in the post-juvenal molt, and are clearly *oreganus*. The adult male from this station (no. 40002) may perhaps be of intermediate character, like some of the Flood Glacier birds previously described, but it is in the midst of the annual molt, and the duller red of the back may be an appearance that is largely due to this cause. The six specimens from Sergief Island, in fully acquired first winter plumage, are all typical *oreganus*.

Neither at Flood Glacier nor Great Glacier were juncos abundant, and it was only by the closest search that specimens were obtained. When we arrived at Sergief Island (August 17) there were no juncos to be seen anywhere. On August 23 two were obtained, the first noted, and a day or two later they became fairly numerous.

### ***Melospiza melodia rufina* (Bonaparte). Rusty Song Sparrow**

Song sparrows are rare in the upper Stikine Valley, or, rather, the species occurs in relatively few places. We found some birds around Sawmill Lake and about marshy spots near Telegraph Creek, and a few in similar surroundings between that town and Glenora. A female collected at Sawmill Lake on June 9 contained an egg that would have been laid in a day or two. A young bird just out of the nest was taken on June 18.

Near Doch-da-on Creek and a mile or two back from the Stikine there were certain marshy meadows where song sparrows were really abundant. Bordering the grassy areas were sloughs grown with reeds and surrounded by willows. Here the song sparrows had evidently been nesting, and at the time of our visit (July 8 to 26) were apparently engaged with their second broods. Full-grown young were more abundant than adults, and by the middle of July we found these young birds spreading out farther and farther away from the central swamps and down toward the river. The old birds remained closely within the more restricted meadows where we first found them, and those collected had every appearance of being engaged in nesting. These adults were extremely shy at all times, and specimens were obtained with difficulty.

At Flood Glacier there were a few song sparrows, seen mostly in patches of fireweed near the river. All taken were juvenals, apparently wandering from the nesting ground, as we had found them at Doch-da-on Creek. We found no place near Flood Glacier offering suitable

breeding grounds for song sparrows. None of the birds was seen at Great Glacier but one was noted near the custom house just above the boundary, August 16.

At Sergief Island song sparrows were abundant. They were mostly at the upper edge of the marsh land, just below the coniferous forest, where a bordering strip of dense underbrush (alder, willow, devil's-club, and other shrubbery) afforded shelter to many birds of similar habits. The song sparrows ventured some distance out onto the marshes, but always along narrow tidal channels where tall grass overhanging the sloughs made arched passageways beneath which the birds found concealment when need arose.

A large proportion of those seen at Sergief Island were young birds, and young and old were mostly in various stages of molt. A young male taken August 18 is in first winter plumage throughout. Most of the young birds seen at that time were still in juvenal plumage; one taken as late as September 1 had not yet begun the molt from that stage. Two adults shot August 18 and 22, respectively, had not yet begun to molt; another taken on September 1 had almost completed the change.

Forty-four specimens were collected (nos. 40020-40044, 40047-40065), as follows: Telegraph Creek, three adult males, two adult females, one juvenal female; Doch-da-on Creek, three adult males, ten juvenals; Flood Glacier, four juvenals; Sergief Island, two adult males, one adult female, five immature males (first winter plumage), thirteen juvenals.

I had anticipated that the song sparrow of Telegraph Creek would prove to be different from the coast bird, and that it would probably be *Melospiza m. inexpectata*, as a specimen ascribed to that race was recorded from Telegraph Creek by Riley (1911, p. 234) in his description of the subspecies. I am, however, unable to distinguish any points of difference between birds from the upper Stikine Valley and those from the coast. They seem to me to be all referable to *rufina*.

Upon first consideration it seems strange that in two regions with such diverse faunas in general, as is the case in the upper Stikine and the coast regions, the song sparrow, usually so variable, should be one of the few birds to remain the same in both places. This is by no means inexplicable, however, upon consideration of some of the factors involved. The species *Melospiza melodia* extends much farther north along the coast than it does inland; there is no subspecies of the interior that ranges nearly as far north as does *rufina* of the coast.

It follows that any song sparrow colony of an interior point closely adjacent to the coast (such as the Telegraph Creek region) must have been derived from the coast region.

Song sparrows in other sections are known to be influenced in their distribution by extent of riparian surroundings suited to their needs. They will follow a favorable water course through otherwise unsuitable surroundings, less regardful of faunal or zonal limitations than of the associations of plants and water. It therefore seems apparent that the occurrence of the song sparrow at the headwaters of the Stikine River represents an outpost of *rufina*, an overflow of birds that have penetrated to that point by ascending the river from the coast; not part of another race that is of general distribution throughout the interior. *Melospiza m. inexpectata* may be a recognizable race in the region of the type locality (Moose Lake, British Columbia), in southeastern British Columbia, and southwestern Alberta (cf. Oberholser, 1918a, p. 187), but the song sparrow of northwestern British Columbia is unmistakably *rufina*.

Apparently the song sparrows of the inland regions are not completely enough isolated from the parent stock, or have not been for a sufficient length of time, to produce distinguishable differences. As to the length of time that they have been there we have no means of knowing. As to the completeness of isolation in the upper Stikine Valley, my impression, derived from the season's observations, is that there is practically continuous distribution of song sparrows along the river. Breeding colonies are doubtless scattered, and perhaps at rather wide intervals, but apparently migrating birds occur at any point.

There is an interesting point involved in the migration of the song sparrows at the upper end of the Stikine Valley. Do these birds travel north and south to the eastward of the coast range, as is the case with so many other species of that region, or do they follow the Stikine to and from the coast? Our own observations shed no light upon this question. It can hardly be solved save by some person who is permanently residing in the country.

In this connection it may be noted that Brooks (1912, p. 253) definitely cites the subspecies *rufina* as the form occurring at Okanagan, British Columbia, where the fauna otherwise is mostly of the interior. Also, Taverner (1919, p. 84) records *rufina* as the song sparrow at Hazelton, in the interior of British Columbia, some two hundred miles south of Telegraph Creek. I have seen some of Taverner's Hazelton specimens and agree with him in his determination.

The bird collection of this Museum contains sixty-three specimens of *rufina* from the islands and mainland of southeastern Alaska, representing many island localities and several points on the mainland. The largest series from any one place is that from Sergief Island. The Alaskan series as a whole displays considerable variation, in color, in general size, and in size and shape of bill. Whether these differences can be correlated with different habitats, island and mainland, or whether they are merely differences between individual specimens, cannot be settled with the material at hand; there are too few breeding birds from any one place. The variation is considerable, and it includes breeding birds that are just like the Telegraph Creek specimens. For the present, at least, the whole aggregation had best be left under the name *rufina*.

There is one kind of departure from the normal *rufina* that is comprehensible, and that is a variation illustrated in many individuals tending toward *caurina*, the subspecies breeding just north of the habitat of *rufina*. This trend is especially noticeable among the birds collected upon Sergief Island in August and September, birds which I believe were mostly migrants from the north. Typical *rufina* and *caurina* are widely different in appearance, in size, color, and shape of bill, but there are specimens at hand forming almost every link in a chain connecting one extreme with the other. The same individual, however, does not necessarily exhibit the same intermediate condition in all characters; there are various combinations in different specimens.

TABLE X

Measurements in millimeters (average, minimum and maximum)  
of *Melospiza melodia rufina*

	Wing	Tail	Culmen	Depth of bill
10 adult males from the coast of southeastern Alaska <sup>1</sup>	68.4 (66.2-71.5)	64.8 (60.0-70.0)	12.2 (11.2-12.8)	6.7 (6.0-7.0)
6 adult males from the upper Stikine river <sup>2</sup>	67.0 (65.0-71.0)	65.9 (62.0-70.0)	12.2 (11.5-12.8)	6.5 (6.0-7.0)

<sup>1</sup>Glacier Bay, 1; Admiralty Island, 2; Chichagof Island, 1; Kuiu Island, 3; Prince of Wales Island, 1; Warren Island, 1; Sergief Island, 1.

<sup>2</sup>Telegraph Creek, 3; Doch-da-on Creek, 3.

During our stay at Sergief Island (August 17 to September 7) it was evident that there was more or less migratory movement of song sparrows. The numbers present fluctuated from day to day in a way that could not otherwise be explained. Typical examples of *caurina* were taken from time to time, as noted elsewhere in this report, which,

of course, were migrants, and the assumption is that those individuals of intermediate character that were taken at the same time were also migrating birds, presumably from some intermediate region near the northern limit of the habitat of *rufina*. Our experience on the upper Stikine leads me to believe that very young birds, even before the juvenal plumage is discarded, may wander many miles from the nesting ground.

***Melospiza melodia caurina* Ridgway. Yakutat Song Sparrow**

A fairly common migrant at Sergief Island, amid the same surroundings as *rufina*. One was seen the day of our arrival, August 17, and the birds were present in fluctuating numbers up to the date of our departure, September 7. The third week of August was the time of greatest abundance. Usually *caurina* and *rufina* could be told apart in life, the greater size and grayer color of the former serving to distinguish it ordinarily. There are, of course, equivocal specimens, as mentioned in this report under *rufina*, that are practically intermediate between the two subspecies, and difficult of determination even when in hand. There are also in the series of *caurina* from Sergief Island some specimens closely approaching the larger *kenaiensis* in appearance. As, however, the latter reach only the minimum measurements of that subspecies it seems best to place them all under *caurina*. There is thus in the available series of *caurina* a considerable range of variation exemplified, from small, reddish colored birds not widely different from *rufina*, to large, gray colored ones that could be inserted in a series of *kenaiensis* without violence.

There is one bird from Sergief Island (no. 40045, female, August 18) that I refer to *caurina* despite the fact that it is largely in juvenal plumage and was collected in the breeding range of *rufina*. Such of the first winter plumage as has been acquired is distinctly of the *caurina* type, and in the flesh the bulk of this bird was decidedly greater than that of the average *rufina*. Despite the youth of this individual, I believe it to be a migrant from the distant habitat of *caurina*. Juvenals of *rufina* also were found traveling far from the nesting ground.

Fourteen specimens of *Melospiza m. caurina* were taken at Sergief Island, on dates ranging from August 18 to September 5 (nos. 40045, 40046, 40066–40077). The series comprises one adult male, one adult female, five immature males, six immature females, and the juvenal female above described.

***Melospiza lincolni gracilis* (Kittlitz). Forbush Sparrow**

Probably occurs throughout the upper Stikine Valley, but, judging from our experience, in small numbers and at widely scattered points. A female shot June 9 at Sawmill Lake had laid part of its set of eggs; just one other bird was seen at that locality. The species was next encountered at Doch-da-on Creek, where one pair, perhaps more, had nested in the tall grass of a meadow. A young bird caught in a mouse-trap at Flood Glacier was the only one seen at that station.

At Sergief Island the species was abundant. Many of the birds were there when we arrived on August 18, and they greatly increased in numbers within the next few days. At the upper margin of the marshes, that section which is but rarely inundated by the tides, there is much willow brush, increasing in density and size of the trees as the salt water is left behind. The lower edge of this strip, where the willow brush was about waist high and rather scattered, and with thick grass beneath, was the preferred habitat of the Forbush sparrow, and here the birds literally swarmed. I was accustomed to think of this species as being rather solitary in its habits, but here, whether or not the birds were in constantly associated flocks, their choice of surroundings brought hundreds of them closely together. In traveling through the willow brush one flushed them from every thicket. On August 22 I stopped to count those that hopped up into the branches of one small bush, preparatory to taking flight at my approach, and there were fifteen in sight at once. The species was still present at the end of our stay, September 7, but much fewer in number.

Fifteen specimens were collected: an adult female and an adult male from Sawmill Lake (nos. 40078, 40079), two adult females and two juvenals, male and female, from Doch-da-on Creek (nos. 40080-40083), one juvenal male from Flood Glacier (no. 40084), and eight specimens from Sergief Island, two adult females, five immature males, and one immature female (nos. 40085-40092). The young birds from Sergief Island have all completed, or nearly completed, the post-juvenal molt. An adult female taken August 18 is in the midst of the annual molt. The tail feathers are all gone, and the wings so nearly bereft of flight feathers that the bird could scarcely fly. The second adult female, taken August 22, has finished the molt.

The specimens from the upper Stikine Valley are to my eye indistinguishable from the coast birds, and I therefore consider them all of the subspecies *gracilis*. There is no question of the distinctness of

this northern race from the paler colored and more narrowly streaked form breeding in the high mountains of California which is regarded as *lincolni*, but just what relation either of these races bears toward typical *Melospiza lincolni lincolni* from eastern North America I do not know. I have no material available from any eastern points.

For the use of the name *Melospiza lincolni gracilis* (Kittlitz) rather than *M. l. striata* Brewster (as in the A. O. U. *Check-List*), see Oberholser, 1906, p. 42.

***Passerella iliaca unalaschcensis* (Gmelin). Shumagin Fox Sparrow**

Two fox sparrows taken upon Sergief Island, September 5, are referable to this subspecies, an immature female (no. 40107) and an immature male (no. 40108). The two birds were together, in an assemblage of song sparrows, golden-crowned sparrows, and hermit thrushes, feeding in a tangle of red-berry elder, alder, and devil's-club. The Shumagin fox sparrow is a migrant through this region, and it is probably of rare occurrence.

***Passerella iliaca fuliginosa* Ridgway. Sooty Fox Sparrow**

Among the most interesting of the season's discoveries were those relating to the manner of occurrence of *Passerella* in the region explored. Our first experiences were disappointing. I had confidently expected to find some form of this species in the Telegraph Creek region, either *P. i. iliaca* or *P. i. altivagans*, but failed to do so. It does not follow, of course, that one or the other of these birds does not occur locally somewhere in that general region, but if so I believe it will be found on the higher mountain slopes. I do not believe we could have overlooked the species had it been present in the lower valley.

Fox sparrows were first encountered at Doch-da-on Creek. On July 17 an adult male was obtained, first heard singing from its perch near the top of a small willow. A young bird was taken near-by the same day. Both were in brushy bottom land near a slough, a tangle of willows growing amid nettles, tall grass, and other shrubbery, not at all the kind of place that fox sparrows might be supposed to inhabit.

Later on, at Flood Glacier and again at Great Glacier, fox sparrows of the same subspecies were shot at various times. The birds were far from abundant, and it was only through the most assiduous search that specimens were obtained. They inhabited the densest



brush, where they remained out of sight for the most part, and there were neither songs nor call notes to draw attention to their presence. At Sergief Island one specimen referable to this subspecies was taken, on August 27.

In all, fourteen specimens were collected (nos. 40093-40106), as follows: Doch-da-on Creek, one adult male, one juvenal male; Flood Glacier, one adult female, one juvenal male, two juvenal females, one juvenal, sex undetermined; Great Glacier, one adult male, two adult females, two juvenal males, one male in first winter plumage; Sergief Island, one male in first winter plumage. The adults are all in worn breeding plumage or just beginning the annual molt. Of the young birds, some are in juvenal plumage throughout, some are partly through the post-juvenal molt, and two, from Great Glacier, August 10, and Sergief Island, August 27, respectively, are in first winter plumage throughout.

I had supposed that the form of fox sparrow that would be found inhabiting the mainland coast of this part of Alaska would necessarily be *P. i. townsendi*, which is known to occur much farther south on certain of the islands. Our Stikine birds, however, unquestionably are not *townsendi*; for the present, at least, they must be considered as *fuliginosa*. In my "Revision of the avian genus *Passerella*" (1920, p. 149), I have described a series of fox sparrows, winter visitants taken mostly in the vicinity of Berkeley, California, that I have referred to *fuliginosa*, although they are not typical of that form. The statement there made is that these birds are too unlike summer examples of *fuliginosa* from Washington and Vancouver Island to come from that region, and that they must be migrants from some other section. It was intensely interesting to discover that the Stikine River summer birds exactly matched the winter birds described from California.

As between Alaskan examples of *townsendi* and the Stikine River *fuliginosa*, we have in both series, for comparison, adults in similarly worn breeding plumage; also young in juvenal plumage, molting into first winter plumage, and in first winter plumage throughout. The color differences are apparent in every stage. The discovery of *fuliginosa* in this part of Alaska and British Columbia discloses certain departures from the distribution of that subspecies and of *townsendi* as given by me in the "Revision" above cited (Swarth, 1920, pp. 144, 149; map, fig. N). *Fuliginosa* evidently occurs from Puget Sound northward to the Stikine River, but, north of Vancouver Island, probably on the mainland only or perhaps on islands close to the British

Columbia coast. *Townsendi* occurs southward on various islands off the coast of southeastern Alaska, and on the Queen Charlotte Islands, British Columbia; its occurrence in summer on the mainland of southeastern Alaska is questionable. I know of no *breeding* records from that region. On the map above cited there is a cross indicating an occurrence at Helm Bay (south of the Stikine River), but the bird upon which that record is based was an August specimen and may have traveled some distance. I, myself, in 1909, collected many specimens of *townsendi* at Port Snettisham and the Taku River, Alaska (north of the Stikine River), and under circumstances that make it seem likely that those were breeding stations, but no nests were actually found. In field work of that same year at Boca de Quadra, the Chickamin River, and Bradfield Canal (on the mainland south of the Stikine River), and at Thomas Bay (a short distance north of the Stikine), no fox sparrows were seen (see Swarth, 1911, p. 93). There is a record of the occurrence of *townsendi* in June on Wrangell Island, near the mouth of the Stikine River (Swarth, 1920, p. 146).

The facts now indicate that the summer distribution of *fuliginosa* is from extreme northwestern Washington and Vancouver Island northward on the mainland only, at least to the Stikine River. On the latter stream it extends inland about a hundred miles, following the course of the river. Its extension inland elsewhere is unknown to me. In fact, I know of no records of *fuliginosa* from any mainland station between the two extremes of its range, Puget Sound and the Stikine River.

There is another point to be considered, namely, the possibility of subspecific difference between *fuliginosa* of the Puget Sound region and the bird I have called *fuliginosa* from the Stikine River, sufficient difference, that is, to be worthy of recognition in nomenclature. This is a contingency that may have to be met in the future. In another connection I have pointed out in some detail differences that appear to exist between the two lots (Swarth, 1920, pp. 149-150). Briefly, the series comprised of the Stikine River specimens and the winter birds from Berkeley differ from certain Vancouver Island specimens and from the type specimen of *fuliginosa* in being of a duller tone of brown, in having the lower tail coverts less tawny, and in the more stubby bill. The differences are real, as far as the series go, and appear to be fairly constant; the difficulty lies in the few specimens available of typical *fuliginosa*. Under the circumstances further subspecific division does not at present seem desirable.

Fall specimens of *townsendi* from Port Snettisham and the Taku River are notably dark colored, as compared with summer specimens of the same subspecies from the adjacent islands. While this may be due in some degree to seasonal differences of plumage, it may also be indicative of intergradation toward *fuliginosa* at those points.

***Piranga ludoviciana* (Wilson). Western Tanager**

A few seen in the vicinity of Telegraph Creek and Glenora, not more than seven or eight individuals in all. The first noted, a male, was encountered near Telegraph Creek on June 18. A nest was found at Four-Mile Creek, between Telegraph Creek and Glenora, in an alder in the rather dense vegetation that bordered the stream, about twenty-five feet from the ground and four feet from the main trunk. The female was seen on the nest July 5.

Two specimens of the western tanager were preserved, both adult males, and both taken at Glenora, on June 30 and July 4, respectively (nos. 40109-40110).

***Petrochelidon lunifrons lunifrons* (Say). Cliff Swallow**

There were a few pairs of cliff swallows breeding at Telegraph Creek, the only place where we saw the species. Nests, old and new, were placed on several houses in the town. One specimen collected, an adult female, on June 23 (no. 40111).

This specimen is of notably large size, as compared with breeding birds from California and from Illinois. Presumably it belongs to the northern subspecies that Oberholser (1919c, p. 95) has named *Petrochelidon albifrons hypopolia*. As far as it goes, this single bird substantiates the claim of larger size in the northern race. The color differences claimed for that form are not so apparent. The specimen measures as follows: wing, 114; tail, 52.5; exposed culmen, 7; tarsus, 13.

Without wishing to decry the probable existence of a recognizable northern race of the cliff swallow, the writer prefers, in this connection, to use the older name, pending a determination by the A. O. U. Committee on Nomenclature of the several questions involved.

***Hirundo erythrogaster* Boddaert. Barn Swallow**

Breeding in fair abundance in the town of Telegraph Creek. The species was already there at the time of our arrival, May 23, and the birds were occupied with nest building. Nests were seen only on

buildings, and the birds themselves rarely strayed far outside the town. One nest noted, which was placed upon a telephone insulator on the government agent's office, must have been used for some years, for it was built up to a height of six inches or more.

Flocks of migrating swallows that were seen in August at several points down the river were apparently of this species, but could not be satisfactorily identified. These flocks were invariably traveling up stream. In the harbor at Wrangell, August 16, were large numbers of barn swallows, mostly young, flying about and alighting on the shipping and wharves. On Sergief Island, during the next two weeks, the species was seen frequently, traveling southward in large flocks. The flocks diminished in numbers toward the end of the month; the last bird observed was a single individual on August 30.

Two specimens of the barn swallow were preserved, an adult male and an adult female, both taken at Telegraph Creek on June 11 (nos. 40112, 40113).

#### ***Iridoprocne bicolor* (Vieillot). Tree Swallow**

Just one pair seen, at Sawmill Lake, near Telegraph Creek. They were nesting in an old woodpecker hole in a dead birch stub at the margin of the lake. A pair of mountain bluebirds were nesting in the same stub. The swallow's nest held three eggs on June 11; the complete set of seven, with the nest, was taken on June 17 (no. 1816). The nest was built largely of coarse grass and pine needles, mixed with some mammal hair, and was lined with large duck feathers. The two parent birds were taken (nos. 40114, 40115).

#### ***Tachycineta thalassina lepida* Mearns. Northern Violet-green Swallow**

Abundant about Telegraph Creek. Nesting in crevices in the buildings and in a cliff overlooking the town from the northeast. The birds were settled in their nesting sites when we arrived (May 23), but individuals collected on June 8 had not yet laid their sets. The species was fairly abundant at Glenora. At Doch-da-on Creek, the latter part of July, violet-green swallows were seen frequently.

At Sergief Island, toward the end of August, the species was encountered on so many occasions that it seems probable that it is of regular occurrence as a migrant at some points, at least, on the coast of southeastern Alaska, despite the paucity of records. As far as I know, my own observations on the Chickamin River and at Thomas

Bay are the only ones from the region that pertain to this species (see Swarth, 1911, p. 96).

At Sergief Island small flocks were seen passing over the marshes in migration, usually in company with barn swallows, upon various dates, ranging from August 20 to September 2. On August 28 a flock of a hundred or more circled about over our camp for several hours. Last noted on September 2, when a single bird was taken, the only one observed. It is a question whether the individuals seen migrating at this point were travelers from points to the northward, or whether they had followed the Stikine River from the interior. I am inclined toward the first alternative, for, in our own leisurely descent of the river we had seen no indication of any such migration of these swallows.

Five specimens preserved, two adult females from Telegraph Creek, one adult male from Glenora, and two juvenal males from Sergief Island (nos. 40116-40120).

#### ***Riparia riparia* (Linnaeus). Bank Swallow**

A few seen at Glenora, hovering over the fields or flying up and down the river, skimming low over the water. Probably nesting somewhere in the river banks nearby, but we failed to discover where. At Sergief Island a few were seen from time to time (August 18, 19, and 20), passing over the marshes in migration.

Two adults secured, male and female, taken at Glenora, July 2 and 6, respectively (nos. 40121, 40122).

#### ***Bombycilla garrula pallidiceps* Reichenow. Bohemian Waxwing**

Found in the lowlands bordering the Stikine River, from Telegraph Creek down stream as far as Doch-da-on Creek. There was no obvious reason why the species should not extend still farther down the river, save that a few miles below this point those changes first begin to be apparent in the general character of the region that culminate in the thickly forested and humid conditions prevalent on the coast. Food conditions appeared ideal, for berries of various species, eaten freely by other birds, occur in abundance throughout this region. If it is solely the question of food that governs the erratic wanderings of the waxwing, as is so frequently contended in connection with its appearance in winter farther south, it would seem that the species should have been noted by us along the entire length of the Stikine. It seems evident, however, that there must be some barrier, more subtle

than that formed by the abundance or scarcity of food plants, that keeps the waxwing closely restricted to the upper part of the Stikine Valley.

Similarly, restriction to the lower altitudes near the river is probably significant of zonal limitation. We saw no waxwings at high elevations until July 23, when a flock of about twenty birds was encountered at timber line (about 4000 feet) on the mountain above Doch-da-on Creek.

During our first two weeks of field work, at the Junction, the species was not once observed. Presumably the slightly greater elevation at that point was enough of a barrier to keep the waxwing in the warmer section by the river. When we moved from the Junction to Telegraph Creek the birds were encountered at once, and they were found in some numbers thereafter at various nearby points.

A wood road, following the creek from which the town derives its name, turns abruptly aside some half a mile up stream, ascends the steep embankment on the west, and thus reaches a terrace that extends for several miles. Here waxwings were seen upon our first visit to the place, and it was later found to be a favorite resort.

On the morning of June 9 I had my first glimpse of the birds; my attention was attracted by the call note, and a moment later a flock of a dozen or more swung past and disappeared over the tree tops. Later in the day others were seen at almost the same place, two together at two different points. During the next ten days waxwings were seen continually in the same general locality, sometimes two together (mated pairs we supposed at the time), sometimes in small flocks. We shot a few, but mostly we watched them and followed the "pairs" about, hoping, but scarcely expecting, that they would lead us to a nest. The actions of these birds were extremely puzzling, for they seemed quite carefree, and many were in flocks. When we did obtain both birds of a "pair" they proved to be two males. Finally it began to dawn upon us that the waxwings were coming daily to a favorite feeding ground—nothing more; when disturbed they always disappeared in the same direction over some low hills to the westward; and our search was pursued in accordance with this suggestion, with satisfactory results.

The terrace or plateau above mentioned, of which so far we had merely skirted the eastern edge, extends westward a mile or more, is quite level, and but sparsely covered with forest growth. A year or more before our visit it had been swept by fire and a large part of the

timber destroyed. As we saw the place there was very little underbrush of any sort, a great many dead trees, mostly pines with some poplars, and a scattering growth of live trees that had escaped destruction. The conifers were the lodgepole pine (*Pinus contorta*), and were all small trees.

On June 19 we first saw evidence of nesting activities, though, as we afterward learned, the birds must have been busy for some time. On this occasion a pair of birds flew past, each with nest material in its bill, and disappeared in a clump of little pines a short distance away. A short search discovered the nest, just well started, in one of the pines, some six feet from the ground, and quite conspicuous to the view. A second nest was found a short distance away at a point where there had been an Indian wickiup, occupied by a solitary old witchdoctor. Several days before, this habitation had been destroyed by fire, and some of the surrounding trees, including the one with the nest, somewhat scorched. Apparently the fire, smoke, and noise had been too much for the parent waxwings, and they deserted the nest, which contained five newly hatched young. The young were pretty well dried up when found.

On June 22 the third nest was discovered. Two birds were seen in flight toward a pine a hundred yards or so distant. One, the male presumably, lit in the top of the tree, the other disappeared in the foliage below. Almost instantly the male flew high in the air, joined two others that were passing by, and all three went off together toward the slopes where we had previously found so many of the birds feeding. An inspection of the pine disclosed the waxwing's nest. The tree was only about twenty-five feet high, with straggly branches and little foliage. The nest rested upon limbs and against the trunk, about fifteen feet from the ground. It contained six eggs, almost ready to hatch.

During the next few days several other nests were found. A record was kept of each one, though they did not all yield sets of eggs. Following are the particulars of all the nests discovered:

No. 1 (Mus. Vert. Zool., no. 1819). Found June 19, nest just begun; June 21, nest completed; June 22, contained one egg; June 24, 3 eggs; June 25, 4 eggs; June 26, five eggs, set taken. Nest in lodgepole pine (tree about twelve feet high), six feet from the ground, resting on two small branches and against trunk. Greatest outside diameter about 230 mm.; inside diameter, 77; outside depth of main nest structure, 90; depth of nest cavity, 51. Material used: dead twigs

from pines and poplars, dry black moss from the trees, white, cottony plant fiber, and, for lining, dry grass and a few feathers. See figures AA, DD.

No. 2 (Mus. Vert. Zool., no. 1817). Found June 19; a recently abandoned nest containing five dead young, newly hatched. In situation a duplicate of the last: in a little pine, about six feet from the ground, and resting on two small limbs and against the trunk. Greatest outside diameter about 230 mm. (straggling twigs projecting farther); inside diameter, 95; outside depth, 77; depth of nest cavity,



Fig. AA. Waxwing on nest in small lodgepole pine; found near Telegraph Creek. Photograph taken June 25, 1919.

32. This was the only nest found with none of the black tree moss in its composition. There is relatively more of the white plant fiber. It is possible that nest no. 1 was built by the pair that abandoned this nest.

No. 3 (Mus. Vert. Zool. no. 1818). Found June 22, with six eggs, within a few days of hatching. Nest in a small lodgepole pine, about fifteen feet from the ground, on three small limbs and against the trunk. Greatest outside diameter about 230 mm.; inside diameter, 90; outside depth, 90; inside depth, 51. Material used: dead pine and poplar twigs, a great deal of black moss, white plant fiber and dry grass. See figure BB.

No. 4. Found June 22. In a little lodgepole pine, about seven feet from the ground. This was the merest beginning of a nest when



discovered. The birds were seen building rapidly on the morning of June 22, but on June 23 they were just as busily engaged carrying the same nest material elsewhere. The new nest was not found.

No. 5. Found June 23. In a dense grove of young pines. Nest much like the ones just described, but with a great deal of the moss and not much white fiber. Contained one fresh egg. The nest was deserted when we found it.

No. 6. Found June 24. In top of a slender pine, about 25 feet from the ground. Nest resting on limbs and against the trunk. Contained five young.

No. 7 (Mus. Vert. Zool. no. 1820). Found June 24. The only nest discovered that was not placed against the tree trunk. This nest was in a lodgepole pine of larger size than most in this locality, in the fork of one of the larger branches, about three feet from the trunk. Both birds were building here at 1 P.M. At 4 P.M. both birds were seen hard at work carrying the nest material elsewhere. When we ceased watching there was very little of the nest left. On July 5 we happened to pass this place and were surprised to see the nest intact and a bird upon it. It yielded a set of five eggs. This nest is not so bulky as some of the others. Outside diameter, 153 mm.; inside diameter, 77; outside depth, 77; inside depth, 45. Construction as usual, of twigs, moss, white plant fiber and dry grass.

No. 8. Found July 5, about half-finished. In the usual location: against the trunk of a small lodgepole pine, about ten feet from the ground. We were not able to return to this nest.

Waxwings were discovered nesting at Doch-da-on Creek, fifty miles down the river, under slightly different conditions from those at Telegraph Creek. On July 9 two occupied nests were found there, and two apparently of the previous year, all in the same patch of woods. This tract was composed mainly of balsam firs of rather large size, with an admixture of cottonwoods and poplars, and with but little underbrush. While these woods were thus fairly open, they were still much denser than those in which we found the waxwings nesting at Telegraph Creek. The two occupied nests were less than a hundred yards apart, were exactly alike in location and structure, and when found each contained one fresh egg. Each was near the top of a fir, about twenty-five feet from the ground, supported upon a branch and by surrounding twigs, and close to the trunk. On July 15 one of these nests was taken, together with a set of three eggs. The other contained two eggs, and was left undisturbed. No more eggs were laid in this nest, the female being still incubating the two eggs some days later.

The nest taken (no. 1821) is more compact than most of those found at Telegraph Creek, due to the firmer support given by the short, stiff fir twigs, closely encircling the structure, as compared with the sparse and slender branches of the lodgepole pine. It measures as follows: outside diameter, 178 mm.; inside diameter, 76; outside depth, 76; inside depth, 38 mm. The black moss enters into the construction of this nest to a greater extent than in any of the others. There is but the scantiest framework of twigs on the outside, lending support to the moss, which forms about nine-tenths of the entire structure. There is but very little of the white fiber that is so conspicuous in some of the others.

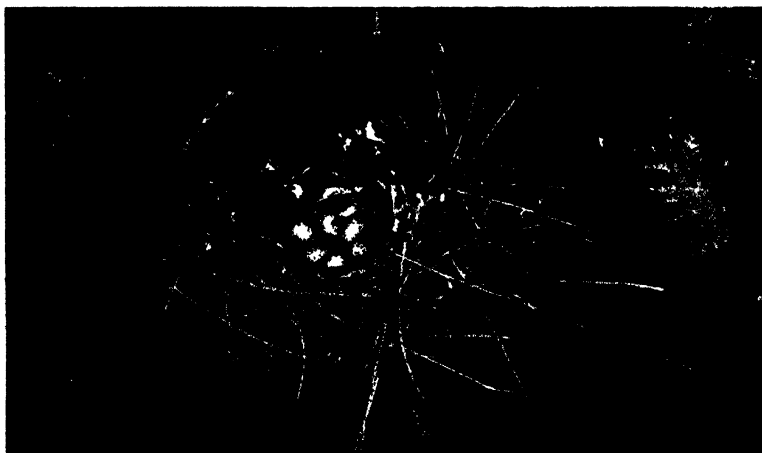


Fig. BB. Nest and eggs of waxwing found near Telegraph Creek; nest near the top of a small lodgepole pine. Photograph taken June 22, 1919.

It will be seen that the waxwings' nests were all very much alike in structure and location. All were in conifers, in rather open woods, and not far above the ground (six to twenty-five feet). The nests with one exception were against the trunk of the tree. The building material was always the same, an outer structure of dead twigs, lending support to a mass of black moss and white plant fiber. Dry grass was used as a lining sometimes but not always. The black moss was the one material that was used in the greatest amount, and it appears in all but one of the nests. This moss grows abundantly on the conifers of the region, depending from the branches in great masses, like coarse hair. The white plant fiber that is also so conspicuous in the nests is from the seed pod of the previous year's dead "fireweed" (*Epilobium angustifolium*).

There was one additional feature in which the nests were all alike, something that could not be preserved. Invariably there was a mass of stuff depending six or eight inches below the nest proper, so loosely attached as to seem on the verge of dropping away. This stuff was mostly the moss and the white plant fiber; usually additional tufts of these materials were adhering to nearby branches.

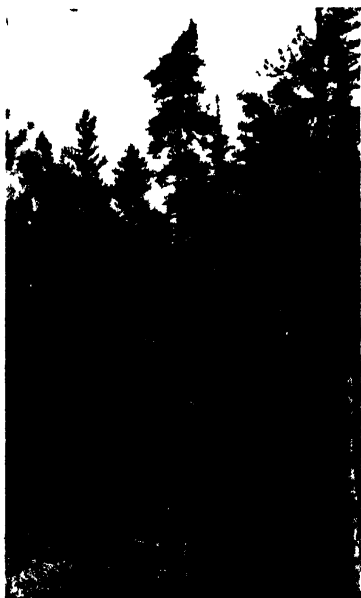


Fig. CC

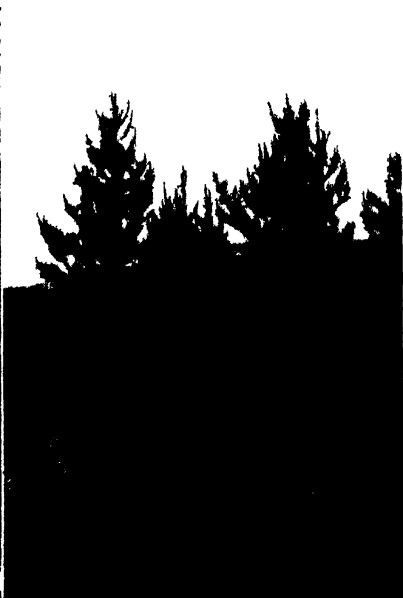


Fig. DD

Fig. CC. Grove of small fir trees where waxwings were found nesting at Doch-da-on Creek. A nest may be seen in the tree in the center of the picture, near the top of the tree and close to the trunk. Photograph taken July 15, 1919.

Fig. DD. Grove of small lodgepole pines where waxwings were found nesting near Telegraph Creek. There is a nest in the tree at the left of the picture, about halfway up and against the trunk. Photograph taken June 20, 1919.

The nests seemed large for the size of the bird, and they were not well hidden. Usually they were conspicuous, once we had found them, and no difficulty was experienced in finding a nest we had reason to suppose was in a certain locality. It was surprising, though, how frequently we both walked past nests without seeing them, not having noted the birds, though once found we marveled how we could have overlooked them.

The Bohemian waxwing, that is, the subspecies *Bombycilla garrula pallidiceps*, has been discovered nesting at so few points in North America that it seems worth while to give a résumé of the findings of previous observers for comparison with our own.

The first North American breeding record was announced by Baird (1866, 406), as follows: "The only instances on record of their discovery in America are of a nest and one egg by Mr. Kennicott, on the Yukon, in 1861, and a nest and single egg on the Anderson River, by Mr. MacFarlane, both of which, with the female parents, are in the possession of the [Smithsonian] Institution."

Kennicott's nest was described by Brewer (in Baird, Brewer, and Ridgway, 1874, 398): "At Fort Yukon, July 4, Mr. Kennicott met with the nest of this species. The nest, which contained but one egg, was about eighteen feet from the ground, and was built on a side branch of a small spruce that was growing at the outer edge of a clump of thick spruces, on low ground. The nest was large, the base being made of small, dry spruce twigs. Internally it was constructed of fine grass and moose hair, and lined thickly with large feathers."

In 1901, Brooks discovered the waxwing breeding at 158-Mile House, in the southwestern corner of the Cariboo district, British Columbia.

I first noticed them there on 11th June, when I came across a small flock and shot one which proved on dissection to be a female about to lay. On returning to the same spot I found the Waxwings, consisting of a colony of five pairs of birds, still there, and soon discovered a nest in a Murray pine, near the end of a limb and about twenty-five feet up, this then (12th June) contained two eggs. On the 15th I took this set, which then consisted of four eggs. The nest was loose and bulky, composed of *Usnea* moss, dry grass and weed stems, and lined with fine material, with a few green aspen leaves in the lining, no doubt to render the eggs less conspicuous. On the 26th June I carefully looked over all the trees in the neighborhood with my binocular, and found three more nests, all in tall Douglas fir trees; two of these I was able to climb to; each contained four eggs within a few days of hatching. The nests were similar to the first but without the green aspen leaves, probably due to the fact that the nests were better concealed from above (Brooks, 1903, p. 283).

On June 10, 1908, R. M. Anderson found the species nesting near Fort Smith, at the boundary between Alberta and Mackenzie. In nearly all respects the circumstances were as we found them on the Stikine.

Soon I saw what appeared to be a nest, a moss-covered bunch near the top of a straight, slender jack-pine (*Pinus banksiana*), about 45 feet from the ground. The nest, however, was so artfully concealed and draped with mosses that I could not be sure that it really was a nest until I actually peered over the edge of it.

The nest contained six eggs, which proved to be almost fresh; incubation less than one day. . . .

The nest measured  $6\frac{1}{2}$  inches in outside diameter, and  $2\frac{1}{4}$  inside; depth (outside) 3 inches, (inside)  $1\frac{1}{2}$  inches; composed externally of small, short, dead pine twigs loosely arranged and partially covered with pale green moss, and small bunches of white cottony vegetable fibres. The nest lining consisted of a few fine grasses, a few bunches of fine woolly black moss, and bunches of the soft white cotton.

The tree containing the nest was at least twenty feet from any other tree and had no limbs for at least twenty feet from the ground. The nest was placed close to the body of the tree and supported by two small nearly horizontal limbs and a few lateral supporting twigs from these (R. M. Anderson, 1909, pp. 11-12).

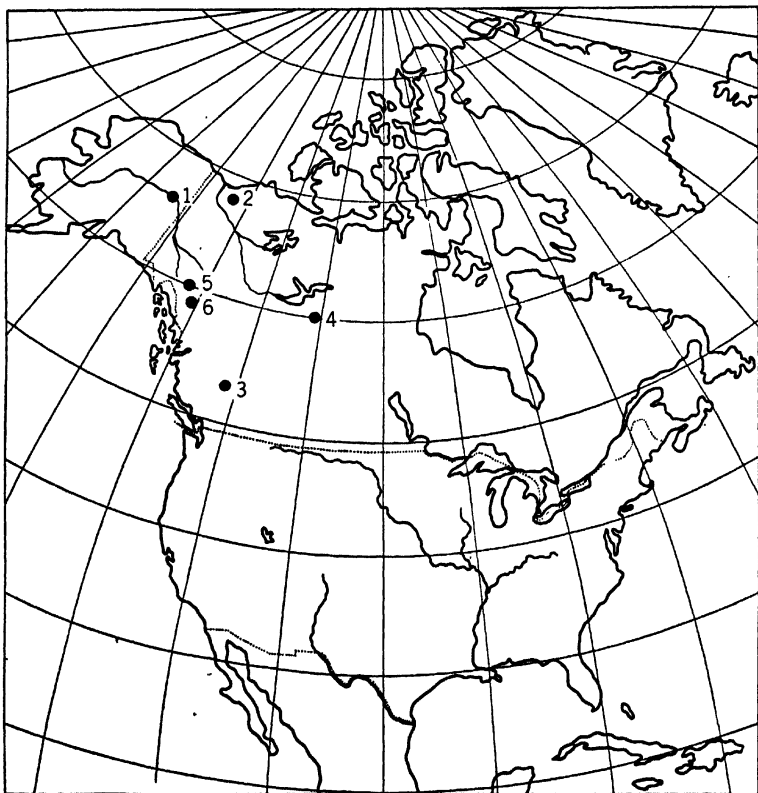


Fig. EE. Map showing the known breeding range of the Bohemian waxwing in North America. Circles indicate points where the species has been found nesting. 1. Fort Yukon, Alaska, July 4, 1861 (Baird, 1866, p. 406). 2. Fort Anderson (Baird, *loc. cit.*). 3. 158-Mile House, Cariboo District, British Columbia, June, 1901 (Brooks, 1903, p. 283). 4. Fort Smith, Alberta, June 10, 1908 (R. M. Anderson, 1909, pp. 11-12). 5. Atlin Lake, British Columbia, July, 1914 (E. M. Anderson, 1915b, pp. 145-148). 6. Telegraph Creek, British Columbia, June and July, 1919 (Swarth and Dixon, MS).

In July, 1914, Ernest M. Anderson found the Bohemian waxwing breeding on islands in Atlin Lake, in the extreme northwestern corner of British Columbia. On July 8 he took four sets of eggs (E. M. Anderson, 1915b, pp. 145-148). Without going into details, it may be said that in all essential respects of nest construction and location, his findings accord very closely with our own.

These few records, covering six localities in the Canadian northwest and Alaska, appear to be the only authenticated instances of the actual taking of nests and eggs of the waxwing in North America. In addition may be cited Riley's statement (1912, p. 69) of the probable nesting of the species at Moose, in southeastern British Columbia. Though he found no nests, the conditions under which he found the birds were sufficient proof of their breeding.

The nesting of the European subspecies (*Bombycilla garrula garrula*) was most carefully described by John Wolley (1857) in his memorable account of the first discovery of the nest and eggs of the Bohemian waxwing in Finland, and by Newton (1861) in a longer paper describing the same material. Wolley's description of the nest reads in part as follows:

" . . . the main substance [of the nest] is of the kind of lichen commonly called tree-hair. . . . This main substance of the nest is strengthened below by a platform of dead twigs, and higher up towards the interior by a greater or less amount of flowering stalks of grass, and occasionally pieces of equisetum." He also found a little reindeer lichen, green moss, willow cotton, and fiber of grass leaves in the structure; sometimes one or two feathers in the lining. The nests were " . . . built on the branch of a tree, not near the bole, and rather . . . standing up from the branch . . . , than supported by twigs touching it at the sides. . . . Of six nests, four were in small spruces, one in a good-sized Scotch fir, and one in a Birch—all placed at a height of from 6 to 12 feet above the ground . . . the nest seems generally much exposed. . . . In parts of the forest considerably open.

"Five seems to be the ordinary number of eggs; in one nest only there were as many as six.

"In the backward and cold spring of 1856, Waxwings had their full complement of eggs about the 12th of June" (Wolley, 1857, pp. 55-56).

The eggs of the four sets of the American subspecies obtained in 1919 on the Stikine River, and now in the Museum of Vertebrate Zoology, measure as follows:

Set no. 1818.  $25.0 \times 17.8$ ,  $24.2 \times 17.8$ ,  $25.5 \times 18.5$ ,  $25.2 \times 17.5$ ,  $25.5 \times 18.2$ ,  $26.0 \times 18.0$ .

Set no. 1819.  $24.2 \times 17.0$ ,  $27.0 \times 17.0$ ,  $27.0 \times 17.2$ ,  $26.0 \times 17.5$ ,  $26.2 \times 17.2$ .

Set no. 1820.  $26.8 \times 17.8$ ,  $25.0 \times 18.0$ ,  $26.5 \times 18.0$ ,  $25.5 \times 18.0$ ,  $26.8 \times 17.8$ .

Set no. 1821.  $24.8 \times 18.0$ ,  $23.5 \times 17.5$ ,  $24.0 \times 18.0$ .

In color, three of the sets are much alike, a pale glaucous blue, close to Ridgway's "pale dull glaucous-blue," but more washed out. This ground color is marked rather profusely with blackish dots and with a few fine, irregular lines, the dots mostly quite small and occurring over nearly the entire egg, though less numerous at the smaller end than elsewhere. There are also obscure underlying spots of bluish, but faintly seen. The fourth set (no. 1821) is more olivaceous, the ground color close to Ridgway's "mineral gray." The spots are fewer in number than in the other sets, larger, and more sharply defined.

As to plumage, the more conspicuous variable features in the waxwing's markings are the waxlike tips to the secondaries, the white and the yellow markings on primaries, primary coverts, and secondaries, and the yellow tips to the rectrices. The most elaborate study yet made of the plumage of this species is that written by Henry Stevenson (1882), based upon 144 specimens killed in England during the winter of 1866-67. Many of his statements are of interest in connection with the series of waxwings now in the collection of this Museum.

First, as regards the wax secondary tip, he gives the following table, including those birds of which the sex had been ascertained by dissection.

MALES	FEMALES
3 had 4 tips	*1 had 2 tips
7 had 5 tips	4 had 3 tips
14 had 6 tips	7 had 4 tips
14 had 7 tips	6 had 5 tips
3 had 8 tips	7 had 6 tips
—	2 had 7 tips
41	1 had 8 tips
	—

A similar table of 38 specimens of the American subspecies in this Museum of which the sex has been ascertained is as follows:

MALES	FEMALES
2 have 3 tips	1 has no tips
6 have 4 tips	1 has traces of 2 tips
5 have 5 tips	2 have 3 tips
8 have 6 tips	2 have 4 tips
1 has 7 tips	2 have 5 tips
—	7 have 6 tips
22	1 has 7 tips
	—
	16

Besides those thus tabulated there are certain other variants. One male has a faint trace of a wax tip on a secondary on one side only. One female has two on one side, three on the other. One female has four on one side, two on the other. One female has five on one side, six on the other. Stevenson seemed to believe that such irregularities were due to accidents or wear, but in these birds there is no evidence to show that the unadorned secondaries had received any injury. One female is indicated in the table as having traces of two tips. They are so faint that they can be seen only by the most careful scrutiny, and are devoid of red color. Of all the adult specimens examined, forty-five in number, just one was found (a female) with absolutely no trace of the wax tips. In several cases these tips show a decided tendency to split up like feather barbs. It thus appears that these appendages are formed by the coalescing of barbs, and not by an enlargement of the tip of the central shaft, though the shaft, too, is involved in the general change. The ornamentation, in fact, may well have begun with the coloring of the shaft, spreading later over the adjoining feather barbs. The last stage would have been the coalescing of the barbs, forming the waxlike scale as it is now seen. Various steps of this hypothetical evolutionary development are supplied in the wing and tail feathers of different birds of this series.

The primaries of the waxwing have a white or yellow marking near the tip. This marking is sometimes confined to the outer web, and sometimes continued on to the inner web; the latter, producing a V-shaped marking, has been designated by Stevenson (*loc. cit.*) as the "return margin." In the brightest colored birds these markings are bright yellow on the inner primaries, becoming more and more white on the outermost ones. In the duller colored birds they are white throughout. The V-shaped character is invariably accompanied by



bright yellow outer margins, but the yellow color is not restricted to the individuals that have this "return margin." Some of the birds with the primary markings absolutely confined to the outer feather margins still have them of brilliant yellow. None of the birds with white primary spots have the "return margin."

There are several birds of both sexes at hand with more or less indication of red at the tips of the tail feathers. This is never at all conspicuous, and is usually confined to the shaft of the feather at the extreme tip. In one or two instances the color spreads out over the adjoining vane, but without any coalescing of the red colored barbs; not one bird in the series has any well defined wax tips to the tail feathers similar to those on the secondaries. There is some variation in the yellow tip to the tail feathers, both in intensity of yellow and in the breadth of the marking. There are also some specimens with one or more tail feathers longer or shorter than the rest and of a different tone of yellow, giving the appearance of having been held over from a previous plumage.

Stevenson (*loc. cit.*) after careful study of the extensive series of birds at his disposal was unable to discover any external character distinguishing male from female, though he was inclined to believe "that the assumption of the yellow tinge [on the primary markings] is probably more gradual in the female than in the male." The series before the present writer does not shed any additional light upon this question. Although there is considerable variation in the character of wing and tail markings, it appears to be purely individual. It so happens that the brightest colored bird of the lot is a female (Mus. Vert. Zool. no. 17437, sexed by C. I. Clay). In size (but not in number) of wax wing tips, in "return margins" of primaries, in yellow on primaries, and in size of white spots on secondaries, it is superior to any of the males. In this bird the wax secondary tips are 7 mm. in length, a size attained by only one or two males.

The brood of young birds we collected was naturally of more than ordinary interest. The nest was discovered on June 24, containing five young not more than two or three days old. On July 5 we returned. The nest was in a slender tree that swayed under the least pressure, and at the first disturbance the young birds fluttered to the ground. The brood was about two weeks old at this time. In two or three days more, at most, all would have left the nest voluntarily. The brood consisted of four males and one female.

These young waxwings presented a most striking appearance in life, for to my surprise they exhibited all the characteristic markings of the adult. Not only that, but the yellow tip to the tail was much brighter, more of an orange yellow, than it is in any of the old birds. The wax tips to the secondaries were present in each of the four males but not in the female. Two of the birds had four such tips, one had five, and one had seven, as many as are seen in any of the adults. These wax tips are as large as in many old birds. As rectrices and remiges were but partly grown out, the brightly colored tips occupied a much greater proportion of the whole than is the case in fully feathered birds. The resulting color effect was most bizarre. The young, with their remarkably vivid markings, looked utterly unlike the soberly colored adults.

The four young males are very much alike in color and markings, the only differences in appearance being those arising from the slight difference in stage of development. The marginal primary markings are present, sharply defined, and in each case bright yellow. In many adults these markings are white. In the young males the terminal tail band is orange-buff, the primary tips, light orange-yellow. In the brightest adult at hand the tail band is light cadmium, the primary tips, lemon chrome. In the young female the tail band is somewhat paler than in the males, though still more orange than in any adult. The primary tips are but slightly tinged with yellow.

A still more remarkable feature in the young males is the fact that in each one the rectrices are distinctly tipped with red. These red tips are not fully developed sealing-waxlike scales such as are on the secondaries, but are produced by red coloration of the terminal portion (4 or 5 mm. in length) of the feather shaft of the rectrix.

The female parent of this brood (the only one of the pair collected) is a highly plumaged bird. It has six secondaries of one wing, five of the other, with wax tips, the primary margins are bright yellow, the tail is broadly tipped with yellow, and there is a faint suggestion of red in one or two of the tail feathers.

As regards the young birds, it is seen that they possess all the peculiar markings of the most brightly colored adults except the "return margin" upon the primaries. This is not seen in any of the young. The yellow wing and tail markings are much brighter than in any adult at hand, even than in freshly molted birds with these feathers but partly grown. While the young birds possess all the markings of the adults, they are appreciably different in general body color. They

have a somewhat streaked appearance, though not as much so as in the young cedar waxwing, the whole body is of a duller, darker gray than in the adult, and the young bird has none of the vinous coloring about the head that is seen in the adult. The crest is present but only slightly developed. The young has a dull black line from the nostril to the eye and posteriorly on the head, in resemblance to that on the adult, but in our specimens of young there is just an indication of the black throat. This may be due to the fact that in these birds the feathers of chin and upper throat are but partly developed, but appearances would indicate that in the fully acquired juvenal plumage the throat is whitish, bordered on each side by a line of dull black. The middle of the belly is whitish, the under tail coverts a paler and duller chestnut than in the adult. One feature in which the young waxwings differ notably from the adults is the color of the inside of the mouth. This was a bright reddish (spinel pink of Ridgway) with a short, sharply defined streak of Mathews purple on each side, at the corner of the mouth. In adults the inside of the mouth is flesh color with but a suggestion of bluish at either side on the roof of the mouth. In the young birds the iris is dark. In adults there is a narrow but distinct red ring surrounding the black pupil.

Although the fact that the young Bohemian waxwing possesses practically all the distinctive markings of the most highly developed adult was a surprise to the writer when the birds were first encountered in the field, it is not new in ornithological literature. There have been a few juvenals collected, but although their appearance has been commented upon at the time of capture, apparently the compilers of the more general handbooks have never cited these scanty specimens as representative of the usual condition. Casual mention of an early streaked stage, "similar to that of the cedar bird," is the information usually given. Wolley's description of a young bird, in his account of the first discovery of the nesting of the European subspecies, is as follows:

A young bird caught on the 5th of August, as it fluttered from the nest, had a general resemblance to the adult, though all the colours were more dull. The wax-like ends to the wing-feathers, the yellow tip to the tail, the black patch between the eye and the beak are all there, whilst the rich mahogany of the under tail-coverts is of a quieter brown; the blooming vinous colour of the head and back has not yet emerged from a homely neutral, and the crest is but just indicated by the longish feathers of the crown. The most marked difference between the adult and young is in the throat and under surface generally. There is at present scarcely a trace of the deep black patch of the chin, and the delicate tint of the general under surface of the adult is replaced by mottled

neutral and white. This upon examination is found to owe its appearance to those longer webs, which arising towards the root of each feather, extend as far outwards as the webs which arise nearer its tip, being very pale or white, and thus relieving, on both sides, the last mentioned darker webs (Wolley, 1857, p. 56).

In Gould's "Birds of Great Britain" there is a colored plate figuring adult birds, a nest, and five young. Of the young, three show the back and wings, all with wax tips to the secondaries. These figures are from young taken by Dresser, July 4, 1858, but although five juveniles are figured, in the text the statement is made that four young were in the nest and just two were caught. (Gould, 1873, vol. 2, pl. 21.)

Bishop (1900a, p. 89) describes three fully fledged young from the Yukon region as having the waxlike appendages to the secondaries, but of a paler red than in the adult. One of these same young birds is described in detail by Ridgway (1904, p. 106). Evidently but few young birds of this species have been collected. Judging from those that have been taken, the waxlike secondary tips occur as frequently in the juvenal plumage as in the later stages. In fact, with respect to all the variable features in this species, wax tips, white or yellow wing markings, and yellow tail band, it is not possible to detect any correlation between the extent of these markings or the intensity of their color, and either age, sex, or season. We have, as described, birds in juvenal plumage as brightly marked as any adult. The fact that in the brood of five collected the four males have the wax tipping and the one female lacks these appendages, gives the appearance of this being a sexual feature. To offset this, the female parent of this brood had the wax tips fully developed. Then, the female parent of a set of five eggs, taken the same day, has the wax tips almost entirely lacking.

In commenting upon the Bohemian waxwing as a winter visitant to Montana, where they were abundant, Cameron (1908, p. 46) says:

Only a small proportion had yellow primary bands; in the great majority these were white. Most birds had no red sealing wax appendages visible and were presumably the young of the year. Others, besides showing white edging to the ends of all the primaries except the two first, had four wax tips on the secondaries. These may have been birds of eighteen months old which had moulted twice, having regard to the fact that the waxwing moults only once a year—in October. A few of the birds had brilliant yellow wing bars and numerous vermilion appendages, and I concluded that this small minority were old birds.

Similar lines of reasoning have been followed regarding other birds than the waxwing; that is, different types of plumage have been taken as indicating different ages, rather than descriptions of plumages being based upon specimens whose ages had been definitely ascertained in other ways. There is probably hardly a species where it would seem a more obvious or safer thing to do than to judge the age of a waxwing from the number and size of the waxen wing tips, yet inspection of the juvenal plumage shows how unsafe such assumptions may be.

The most surprising statement in Cameron's account is the assertion that "most birds had no red sealing wax appendages visible." Of the forty-five adults examined in the present connection only one lacks any trace of such an appendage, and except for Cameron's comment I should have believed that it was unusual for a Bohemian waxwing to lack these ornaments. In the smaller cedar waxwing the case is different. An examination of the latter species as represented in this Museum discloses 36 specimens with more or less wax tips to the secondaries, and 41 without a vestige of such marking. Judging from the material at hand, therefore, this character seems to be much more fully developed in *Bombycilla garrula* than in *B. cedrorum*.

The flocking instinct is strong in the waxwing at all times. The nests we found, at two different localities, while not sufficiently close together to merit the term "rookeries," were gathered in close proximity, and to the exclusion of surrounding areas apparently just as well adapted to the purpose. The birds obviously prefer to nest in fairly close company. When a sitting bird left the nest for the short time necessary to feed each day, it was to join one or two others and do the foraging in company. While both birds of a mated pair work at nest construction, apparently all the labor of incubation falls upon the female. Her mate, thrown upon his own resources, usually joined some other unoccupied male. Usually two males fed together; occasionally there were more in company. Flocks were noted all through the breeding season, usually of not more than twelve or fifteen individuals; by the end of July gatherings were seen that were several times as large.

In nest building, male and female worked together. Dixon (MS) observed one pair at their labors for some time and made the following notes: After the observer had taken his station the female arrived with some white plant fiber. She put this fiber in place, and then, sitting in the nest, she turned around and around, shaping thus, with her breast, the nest cavity. Then the male arrived with more of the plant

fiber. He placed it within reach of the female, who proceeded to weave it into the structure. The birds worked so assiduously that the nest was nearly finished by noon of the second day after it was begun.

In approaching and leaving the birds were usually together. Instead of flying directly to the nest they generally lit in some nearby trees, then approached unobtrusively by several short flights through the thicket. In departing similar precautions were used. When perching they almost invariably chose a tree top or some elevated and projecting limb. This was especially noticeable in birds disturbed at their nests, and it was also the manner in which they perched when engaged in flycatching activities.

Different birds varied in the degrees of tameness they showed about the nests. The female of the first set taken remained upon the eggs until the collector's hand was within a few inches of her. Male and female together hovered about for a few minutes, occasionally uttering the usual call note, and raising and lowering the crest. Then they left and did not return at all in the two hours that we remained in the vicinity.

A sitting bird when closely approached invariably pointed the bill almost straight up, and kept the crest closely pressed to the head. The young birds frightened from the nest resorted to the same tactics. On one occasion one of a pair of waxwings, presumably the male, was seen strutting about and exhibiting his beauties to his mate. Considering that the two sexes are alike in every respect, it seemed rather a superfluous performance, but at any rate the one bird was hopping excitedly about from branch to branch, while the other sat still and looked on. The active performer kept the tail partly spread, wings drooping, and crest raised, and the whole body was held stiffly upright. After several minutes the other seemed to tire of the performance and flew away, followed at once by its mate.

Waxwings were seen feeding on insects and also on berries and other vegetable matter. About Telegraph Creek, the first week in June, they were usually seen perched on bare branches and making short sallies after flying insects in true flycatcher style. Early in July a berry-bearing shrub (*Shepherdia canadensis*) of general distribution in the region came into bearing, and the waxwings, as well as other species of birds, fed upon the berries of this plant to a great extent. The young waxwings we took from the nest had also been fed upon these same berries.

Under ordinary circumstances the only sound uttered by the waxwing is a sibilant call note much like that of the more familiar cedar

bird. While notes of the two species are of the same character, still they are distinguishably different. This difference may, perhaps, be indicated by describing the cedar bird's call as a hiss, the Bohemian waxwing's call as a buzz. The note of the latter is somewhat coarser; the listener has an impression of hearing a series of very slightly separated notes, rather than of a continuous sound such as the cedar bird utters. The call note has been commented upon by Cameron (1908, p. 47), who says: "When flying the birds keep up an incessant twittering, so that high passing flocks are immediately recognized by their call of *zir-r-r-r*—a sort of trill."

Griscom and Harper (1915, p. 369) make the following comments upon the waxwing's call: "Though similar in general form to the 'beady notes' of *B. cedrorum*, they are less shrill, are more leisurely uttered, and have a more noticeable rolling sound. They are also more distinct, there being a comparatively greater interval between each syllable in the series. The call has been represented by Seeböhm as *cir-ir-ir-ir-re* (quoted in Sharpe's 'Hand-book to the Birds of Great Britain,' Vol. I, p. 177) and by Cameron as *zir-r-r-r* . . . , but neither rendering seems to express exactly the decided sibilant quality of each syllable."

E. M. Anderson (1915b, p. 146) makes a rather surprising statement regarding the voice of the waxwing. "While on the wing the birds uttered a short succession of high-pitched, screaming notes, closely resembling in character, though not in volume, the cries heard on nearing a Pigeon Guillemot rookery on the seacoast." As far as I am aware this is the only published statement that ascribes to the waxwing any note other than the well-known hissing sound.

A bird shot by the present writer, which fell to the ground wounded, uttered a loud, chattering noise, the only time I ever heard anything of the kind. The young birds we removed from the nest called a great deal. One of the five fluttered off into the bushes where he escaped observation, but he soon began calling and was thus discovered. According to Dixon's notes at the time, the call note of the young waxwing was much like that of a young California shrike.

The American waxwing was given the name *Bombycilla garrula pallidiceps* by Reichenow (1908, p. 191), with the type locality the Shesly River, northern British Columbia. The Shesly River, a tributary of the Inklin, which in turn empties into the Taku, has its source some twenty-five miles northwest of Telegraph Creek, its mouth, some sixty miles beyond. Thus for all practical purposes our Telegraph Creek specimens of the waxwing may be regarded as topotypes.

I had the opportunity of comparing a selection of these skins with European examples of *B. g. garrula* in the United States National Museum. The color differences distinguishing the two forms were readily apparent in the series thus brought together, and the differences appear to me to be sufficiently pronounced to justify the recognition of the American subspecies, *pallidiceps*. (Cf. Oberholser, 1917c, p. 333.)

We collected seventeen specimens of the waxwing, nine adult males, three adult females, four juvenal males, and one juvenal female (nos. 40123-40139).

***Vireosylva gilva swainsoni* (Baird). Western Warbling Vireo**

Common in the poplar woods of the upper Stikine Valley. First taken near Telegraph Creek on May 29; shortly after, the birds arrived in numbers. They were seen daily at Glenora and Doch-da-on Creek, undoubtedly breeding at both places. When we arrived at Flood Glacier, July 26, the species was present in some abundance; at the time of our departure, August 8, the birds were nearly all gone. Whether or not this vireo breeds at the last mentioned locality was not definitely ascertained, but I am inclined to think that it does, judging from the actions of certain individuals. On July 31 a pair of the birds spent nearly the whole day in an alder thicket near our camp, scolding continually at some disturber of their peace that I could not discover. Possibly an owl was roosting near-by. Anyway, the vireos acted much as though they were concerned over the safety of their brood.

At Great Glacier, August 10, two were seen. This was the latest date of occurrence, and Great Glacier the westernmost locality at which the species was noted. Our several points of record apparently constitute the farthest known extension of the range of this subspecies toward the northwest. It is not included by Anderson (1915a) in his list of birds from Lake Atlin, some two hundred miles north of Telegraph Creek. The occurrence at Great Glacier carries the range to within ten miles of the Alaskan boundary, and to within about thirty miles of the coast.

Five adult specimens were collected, two from the vicinity of Telegraph Creek, one from Doch-da-on Creek, one from Flood Glacier, and one from Great Glacier (nos. 40140-40144). These birds are in no wise to be distinguished from others from more southern points in the range of the subspecies, as in California.



**Vermivora celata orestera** Oberholser. Rocky Mountain Orange-crowned Warbler

Warblers of this species are rare in the upper Stikine Valley, or else they are so secretive during the nesting season as to avoid observation. Two males (nos. 40145, 40146) were taken near Telegraph Creek on May 27 and 31, respectively, probably migrants, and no more were seen for some time. At Doch-da-on Creek, July 18, when many birds were beginning to move about after the close of the nesting season, a female in juvenal plumage (no. 40147) was obtained. Another young bird, molting into first winter plumage (no. 40148) was taken at Great Glacier, August 11.

The two adults, compared with *Vermivora celata lutescens* of the coast region, are of greater size and duller coloration. Compared with *V. c. celata*, they are more yellowish, and lack the grayish tinge of that race. Thus they exhibit the characters ascribed to *Vermivora celata orestera* Oberholser (1905, p. 242; 1917b, p. 326). The juvenals may be distinguished from young *lutescens* by their gray juvenal feathers, yellow in the latter race.

**Vermivora celata lutescens** (Ridgway). Lutescent Warbler

An immature male just finishing the molt from the juvenal plumage (no. 40149) was taken at Great Glacier, August 11. At Sergief Island some were seen almost daily, evidently migrating and usually in company with other transient warblers and kinglets. Five specimens were taken, all immature, on dates ranging from August 18 to September 22 (nos. 40150-40154).

**Vermivora peregrina** (Wilson). Tennessee Warbler

Met with on but one occasion. On June 12, at a point some five miles southwest of Telegraph Creek, my attention was drawn to an unfamiliar, wheezy song, heard at the edge of a swamp. The singer was discovered flitting from one twig to another in rather slow, vireo-like manner, giving his song at frequent intervals. It proved to be an adult male Tennessee warbler, and was undoubtedly nesting near-by. This specimen (no. 40155) was the only one taken or observed, although I kept careful watch for the species from that time on.

***Dendroica aestiva aestiva*** (Gmelin). Eastern Yellow Warbler

A few seen near Telegraph Creek on May 26 were the first observed, but the species may have arrived some days earlier. The first week in June the birds were abundant and quite generally distributed through the lower valleys. The males were especially noticeable from their habit of perching at the tops of dead and leafless trees, and there singing. The loud song and brilliant color, with no concealing verdure round about, rendered them as conspicuous as such small birds could well be. On June 14 a set of three slightly incubated eggs was taken (no. 1822). The nest was in a cottonwood sapling, some twelve feet from the ground, at the edge of a dense thicket.

At Doch-da-on Creek, the latter part of July, yellow warblers were fairly numerous, and apparently on the move. At Flood Glacier, early in August, and at Great Glacier, about the middle of the month, they were seen frequently, though not in such numbers as had been present farther up the river.

Eighteen specimens of yellow warbler were collected at points on the Stikine River (nos. 40156-40173). The series comprises six adult males and three adult females from Telegraph Creek, three adult males from Glenora, one juvenal female from Doch-da-on Creek, and one adult female and four immature females from Flood Glacier.

*Dendroica aestiva rubiginosa* is commonly considered as occupying both the coast and the interior of Alaska and northern British Columbia (see A. O. U. Committee, 1910, p. 311; Ridgway, 1902, p. 514; E. M. Anderson, 1915*a*, p. 16), but on how extensive a representation of specimens these opinions were based I do not know. My Stikine River series is certainly sufficiently different from the coastal bird to forbid the two lots from being considered of the same subspecies. The series of *rubiginosa* in the collection of this Museum includes thirteen adult males from Vancouver Island and southeastern Alaska. These birds are distinguished in color from other North American races of *Dendroica aestiva* primarily by the combination of dark dorsal coloration, paler yellow underparts, and narrow and scanty chestnut streaking below. The Telegraph Creek birds do not fit into this category at all. In this series the underparts are more brilliantly yellow, and the chestnut streaks, are, in most of the specimens, numerous, broad, and conspicuous. As a series the lot fits in absolutely with *D. aestiva aestiva*, in regard to ventral coloration. In dorsal coloration they average somewhat darker than is the case in an equally extensive series of eastern examples of *aestiva*, though

selections can be made of closely similar specimens in the two series. The variation in dorsal coloration is, I believe, at least partly due to different degrees of wear and fading of the feathers. Specimens of the two series that were taken at approximately the same dates are practically indistinguishable. Measurements of the three lots are given below. They are of little diagnostic importance.

In my opinion the Stikine River birds should not be classed with *rubiginosa*. They present certain differences in appearance; and in habitat and migration they are as sharply set off from the coastal birds as is the case with practically all the other bird species of the region where they were taken. On our trip down the river I watched for yellow warblers carefully and purposely, and they are rather more conspicuous in migration than most small birds. The frequently uttered *zip-zip*, as they fly from bush to bush, attracts attention, and the yellow color is easily seen. At Doch-da-on Creek, at Flood Glacier, and at Great Glacier, yellow warblers were in evidence, obviously migrating, but below Great Glacier I could not see that there were any traveling down stream. My belief is that they find an outlet through the mountains to the southward, and that they do not reach the coast. When we reached Sergief Island, in the habitat of the coastal race (*Dendroica aestiva rubiginosa*), yellow warblers abruptly became scarce. We saw very few, whereas this island was directly in the line of travel down the river. During the first two weeks of our stay, the latter part of August, none was seen. On September 1 several were noted in company with other migrating warblers, and on September 2 a single bird was observed.

On both scores, of physical characters and of distribution, I regard the yellow warblers of the upper Stikine River as best referred to *Dendroica aestiva aestiva*, showing some variation toward *rubiginosa*. Females and immature birds do not show the subspecific characters as do the adult males, and such of the former as were collected at Flood Glacier and Great Glacier are ascribed to *aestiva* on the grounds of probability.

TABLE XI

Measurements in millimeters (average, minimum and maximum) of *Dendroica aestiva aestiva* and *Dendroica aestiva rubiginosa*

		Wing	Tail	Culmen
<i>Dendroica a. aestiva</i>	10 males <sup>1</sup>	62.3 (60.0-64.0)	43.9 (42.0-46.0)	9.6 (9.0-10.0)
<i>Dendroica a. aestiva</i>	9 males <sup>2</sup>	62.4 (60.5-64.0)	44.5 (42.5-46.5)	9.3 (8.5-10.0)
<i>Dendroica a. rubiginosa</i>	10 males <sup>3</sup>	61.5 (59.5-64.0)	43.6 (42.0-46.0)	9.7 (9.0-10.0)

<sup>1</sup>Ontario, Canada, 4; Wisconsin, 4; Michigan, 2.

<sup>2</sup>Telegraph Creek, 7; Glenora, 2.

<sup>3</sup>Prince William Sound, Alaska, 2; Sitka, 1; Chickamin River, s.e. Alaska, 3; Vancouver Island, 4.

***Dendroica coronata hooveri* McGregor. Alaska Myrtle Warbler**

Apparently not common in this region, though some were seen at each collecting station. At the Junction the species was first seen on May 28. Two females taken on May 29 were evidently not breeding; from their actions, these birds and others seen the same day were as yet not even paired. To all appearances they had just arrived. None was seen in the immediate vicinity of Telegraph Creek, but a few pairs were encountered at scattered points some miles away. A few were seen at Glenora. At Doch-da-on Creek, July 8 to 25, small flocks occasionally appeared, sometimes a single family, sometimes evidently composed of two or more broods. The species undoubtedly nests at that point. Whether or not it nests at Flood Glacier, our next station down stream, is questionable, though I should think it likely that a few pairs might extend that far. Several specimens were taken there, and others were seen, some each day. At Great Glacier, August 9 to 16, Hoover warblers were seen frequently, migrating then and evidently traveling down stream. At the time of our arrival at Sergief Island, at the mouth of the river, on August 17, there were none of these warblers present. The first was obtained there on August 30, and in the next day or two the birds were arriving in considerable numbers.

We found no nests. Not many of the birds were seen under such circumstances that it seemed profitable to make search, and when we did attempt to watch individuals that were obviously nesting near-by the results were fruitless. For one thing, the suspects we selected invariably dropped all other interests in order to follow us about, and, each time, the warbler we were watching proved able to sit around doing nothing longer than we ourselves cared to.

The first young bird was collected on June 18, and others in juvenal plumage were taken at later dates, to July 10. One taken at Doch-da-on Creek, July 22, is well advanced in the molt into first winter plumage; another from Great Glacier, August 14, has just begun this change. One from Sergief Island, September 1, still retains much of the juvenal plumage. It is interesting to note that this bird probably traveled some distance from its birthplace while undergoing the molt. Another specimen taken at Sergief Island the same day has practically completed the change into first winter plumage.

Adults in various stages of wear were taken up to the end of July. A female taken July 26 is in extremely shabby and abraded plumage,

but with no new feathers as yet. A male shot August 2 shows the first indication of the postnuptial molt. This is evident only in the flight feathers, the first primary and the adjoining secondary of each wing being partly grown out. No adults were taken at a later date.

This species is one of the few that migrates coastward at the close of the breeding season. There is probably a movement directly southward east of the coast mountains also, but there is no doubt but that there is a regular late-summer line of travel down the Stikine River to the coast. The birds were noted traveling down stream, and the arrival of the species at Sergief Island was in sufficient numbers to warrant the movement being regarded as of regular annual occurrence. Similar conditions have been noted in the late summer at the mouth of the Taku River, another large stream flowing from the interior to the coast, and emptying about one hundred and fifty miles north of the mouth of the Stikine River (see Swarth, 1911, p. 99). There is no information at hand regarding a return in the spring through the same regions.

Twenty specimens were collected (nos. 40174-40193), the series comprising four adult males, seven adult females, six in juvenal plumage, and three in first winter plumage. These were assembled with other material in this Museum for comparison with the eastern *Dendroica c. coronata*. Comparable material in the two subspecies comprised, of *coronata*, 14 adult (summer) males, 10 adult (summer) females, 4 immature (first winter); of *hooveri*, 13 adult (summer) males, 15 adult (summer) females, 11 immature (first winter). There are also midwinter and juvenal specimens of *hooveri*, stages at which there are no comparable specimens of *coronata* available.

Judging from this material, the subspecies *Dendroica c. hooveri* is but faintly characterized. As claimed by the original describer (McGregor, 1899, p. 32), *hooveri* averages slightly larger than *coronata* (see table), but there is much overlapping in measurements. I, myself, am unable to perceive most of the differences of color and markings that have been said to characterize the two subspecies. McGregor (*loc. cit.*) claimed differences in measurements only. Bishop (1900a, p. 90) advanced certain color characters, found in a series collected by himself in Alaska, notably in the summer plumage of the adult male. He says: "Adult males average paler below than typical *D. coronata*, the black markings being narrower, thus giving an effect of broad longitudinal markings rather than black clouding on the chest." This statement is endorsed by Grinnell (1909b, p. 235).

Bishop (*loc. cit.*) claims further that there are color differences in the juvenal plumage. Oberholser (1918b, p. 465) upholds the validity of *hooveri*, asserting "that it differs from *Dendroica coronata coronata* not only in its larger size but in the coloration of male, female, and even young." Ridgway (1902, p. 548, footnote) and Riley (1912, p. 70) each refuse recognition to *hooveri*.

The series assembled by myself in the present connection demonstrates the average size differences claimed to exist. I fail to appreciate any differences whatsoever of color or pattern between adult males and females of the two lots. The juvenal plumages I have been unable to compare. As regards immatures in first winter plumage, examples of *hooveri* are slightly (but distinguishably) darker, more brownish, than comparable specimens of *coronata* (see in this connection Swarth, 1911, p. 99).

TABLE XII

Measurements in millimeters (average, minimum and maximum) of *Dendroica coronata coronata* and *Dendroica coronata hooveri*

Wing	Tail	Culmen	Length of white spot on outer tail feather
<i>Dendroica coronata coronata</i> , 14 males <sup>1</sup>			
72.4 (70.5-76.0)	56.8 (55.0-59.2)	8.9 (8.5-9.5)	20.8 (18.0-22.5)
<i>Dendroica coronata hooveri</i> , 12 males <sup>2</sup>			
75.7 (73.5-79.0)	58.8 (57.2-60.0)	8.8 (8.0-9.2)	22.0 (20.0-25.0)

<sup>1</sup>Massachusetts, 3; Connecticut, 1; New York, 1; New Jersey, 2; District of Columbia, 1; Virginia, 1; Indiana, 2; Illinois, 1; Wisconsin, 1; Minnesota, 1.

<sup>2</sup>Kowak River, Alaska, 4; Yukon River, Yukon and Alaska, 4; Stikine River, British Columbia, 4.

### ***Dendroica townsendi* (J. K. Townsend). Townsend Warbler**

Very few seen at any point, and none under circumstances that would lead to the belief that the species was breeding east of the coastal mountains. First noted at Flood Glacier, where it may, perhaps, have been breeding, or where the birds seen may have wandered from nearer the coast. The first was taken on July 28 (no. 40194) and another on August 3 (no. 40195), both molting from juvenal to first winter plumage. Several more were seen. A male in first winter plumage throughout (no. 40196) was taken at Great Glacier, August 14, and others were observed at the same point. At Sergief Island but one or two were noted, the last on September 1.

***Seiurus noveboracensis notabilis* Ridgway. Grinnell Water-Thrush**

At Glenora, July 7, an adult male was obtained that was undoubtedly nesting near-by. At Doch-da-on Creek, July 21, another adult male was taken.

Of these two birds, the Glenora specimen (no. 40197), as compared with the one from Doch-da-on Creek (no. 40198), is appreciably smaller, with smaller bill, is darker colored throughout, and is noticeably more yellowish below. This may represent individual variation toward the eastern subspecies, *Seiurus n. noveboracensis*. The two Stikine specimens, however, resemble each other more nearly than either one resembles any eastern example at hand.

***Oporornis tolmiei* (J. K. Townsend). MacGillivray Warbler**

Abundant throughout the whole of the region we explored. First noted at the Junction, June 1, one bird seen and another heard singing. During the next few days they were evidently arriving in abundance, and thereafter the song was heard nearly everywhere we went. The first young out of the nest was seen July 13, at Doch-da-on Creek. A day or two later they were emerging in numbers, and as we went through the woods fussy parents in attendance followed us about. The species was noted in moderate abundance at each of our subsequent stations—Flood Glacier, Great Glacier, and Sergief Island. Last noted, a single bird on Sergief Island, September 3.

Nine specimens were collected (nos. 40199–40207). An adult male taken at Flood Glacier, August 4, is finishing the annual molt; the body plumage is practically renewed, but wing and tail feathers are but half-grown. Two young birds taken August 4 and 12, respectively, are in first winter plumage throughout.

Although the MacGillivray warbler is so abundant in the upper Stikine Valley, that region must be nearly the northern extreme reached by the species. It is not included in E. M. Anderson's (1915a) list of birds of the Atlin District, less than two hundred miles to the northward. I do not know whether this warbler should be considered primarily as a species of the interior or of the coast, or whether it is one of the few birds that occurs in equal abundance in both regions. It has been found in summer at various points on the Alaskan coast (Swarth, 1911, p. 101).

***Wilsonia pusilla pileolata* (Pallas). Pileolated Warbler**

In our experience a rare species in the upper Stikine Valley. A few were seen from May 29 to June 1, between Telegraph Creek and the Junction, but these appeared to be migrants. None seemed to be nesting. Next encountered at Flood Glacier, where, on August 4, a bird was caught in a mouse trap. The fall migration was then setting in, and a few days later, at Great Glacier, pileolated warblers were noted from time to time with other migrating warblers. At Sergief Island, the latter part of August they were seen almost daily, the last on September 1.

Six specimens were collected (nos. 40208-40213), two adult males and one adult female from the vicinity of Telegraph Creek, an immature (sex not determined) from Flood Glacier, and an immature male and immature female from Great Glacier. These specimens, in my opinion, are all referable to the subspecies *pileolata*. The three Telegraph Creek adults are slightly darker and duller colored throughout than coastal birds, and to that extent, presumably, lean toward *pusilla*, but they are not so dark colored as eastern specimens of that subspecies. In measurements they do not differ from coastal *pileolata*. With the material at hand it is not possible to tell whether the immatures collected in August at Flood Glacier and Great Glacier are migrants from the interior or from the coast. They are not appreciably different from immature *pileolata* from Alaskan coastal points.

***Setophaga ruticilla* (Linnaeus). American Redstart**

First encountered near Telegraph Creek on June 11. From the actions of the birds seen on that date and the number that were observed, it seemed as though they might have arrived some time previously, but the same ground had been traversed two days before without any redstarts being seen or heard. From this time on the song of this species was heard by us practically everywhere we went in the poplar woods of the lowlands. Males in the plumage of the female, supposed to be birds of the previous year, sang just as did those in the brilliant black and orange livery. That the dull feathered males were breeding was shown in one instance in the capture of a mated pair, evidently preparing to nest. This was on June 15. The male was just like the female save for a few black feathers scattered through the body plumage. The female was almost ready to lay.



At Doch-da-on Creek, the latter part of July, redstarts were present to the same extent as about Telegraph Creek. They were probably still nesting. During the third week in July certain birds could be found daily at the same places in the woods, and they always evinced concern at the presence of an intruder.

That we saw no redstarts at Flood Glacier was probably just chance. The species may not breed that far down the river, but it undoubtedly occurs as a migrant, at least in the fall. At Great Glacier, August 8 to 16, the birds were frequently seen, and to the last day of our stay. This station is about ten miles from the Alaska-British Columbia boundary, and the redstarts were sufficiently numerous there to make it seem certain that some individuals must occasionally stray the few miles farther that would take them into Alaskan territory. I looked carefully for the species on Sergief Island, at the mouth of the river, but did not see it there.

A set of four eggs was taken near Glenora, July 5 (no. 1823). On July 2 this nest was found containing two eggs. It was placed in an upright crotch in a willow sapling, about eight feet from the ground.

Ten specimens of the American redstart were collected (nos. 40214-40223), three adult males, two males, breeding but in female plumage, one adult female, three immature males, one immature, sex not determined. I cannot see that these birds differ in any particular from specimens of *Setophaga ruticilla* from the eastern United States.

### **Anthus rubescens** (Tunstall). Pipit

Small flocks that were seen at Telegraph Creek, May 23 and 24, were undoubtedly of migrating birds, for the species does not breed in that region at so low an altitude. On May 29 a number of pipits were seen at the Summit, twelve miles north of Telegraph Creek, and at an altitude of about 2700 feet. They should have been breeding thereabout, for the locality is suitable, and birds taken on this date appeared to be in breeding condition, but on a later visit to the same place, June 4, no pipits were seen.

Next encountered July 11 on the mountains above Doch-da-on Creek at 4500 feet altitude and higher, where they were fairly abundant and evidently feeding young. They were extremely shy, and though a good many were seen they were usually drifting about through the air, and keeping well out of gun shot. They were calling continually, uttering a note that I have never heard in the winter. This was a sharp, oft-repeated *wheet, wheet, wheet*, the notes given

singly at intervals of several seconds, and uttered both in flight and from the ground. No nests were found and no young seen. When we reached Sergief Island, August 17, the pipits had not yet arrived. The first was seen on August 25, then they increased in numbers rapidly, and were abundant at the time of our departure, September 7.

Three specimens were collected (nos. 40224-40226), an adult male and female from the Summit, May 29, and an adult female from the mountains above Doch-da-on Creek, July 11.

***Nannus hiemalis pacificus* (Baird). Western Winter Wren**

Found nowhere in the lowlands of the upper Stikine Valley. On July 23 an adult female (no. 40227) was taken in a spruce forest on the slope of a mountain above Doch-da-on Creek, at about 3000 feet altitude. This was the only one seen at that point. The species was next encountered at Flood Glacier, where a juvenal was collected on August 2 (no. 40228). At Great Glacier, several were seen and two juvenals collected (nos. 40229-40230). Whether or not the two latter places, at the level of the river, are breeding stations I cannot say. The bird collected upon the mountain above Doch-da-on Creek was, I believe, upon its nesting ground.

At Sergief Island the western winter wren was found amid most unusual surroundings in tall grass and reeds, far out on the marshes. The birds were seen thus daily, foraging over the water just as do the marsh wrens. Sometimes they were in small gatherings, five or six at a time being flushed from the grass.

***Certhia familiaris occidentalis* Ridgway. Tawny Creeper**

A young male just finishing the molt into first winter plumage was taken at Flood Glacier, August 2. On Sergief Island, August 24, two birds in juvenal plumage were collected. These were all that were seen. Once or twice I thought I heard a creeper's call notes at high altitudes in the mountains but was never able to verify my belief. It seems likely that some form of this species breeds throughout the Stikine region, but if so the birds are certainly present in but small numbers or we would have encountered some.

The three specimens collected (nos. 40231-40233) are apparently best referred to *Certhia f. occidentalis*, though they all exhibit a decided leaning toward *C. f. montana*. They may all have been migrants from some inland point, not far distant, inhabited by the subspecies *montana*.

***Sitta canadensis* Linnaeus. Red-breasted Nuthatch**

Not breeding at any point visited. One was seen at Doch-da-on Creek on July 22, at a time when birds were generally beginning to move about, and several more on July 26. An immature male (no. 40234) was taken at Flood Glacier, August 2. No more were seen.

***Penthestes atricapillus septentrionalis* (Harris). Long-tailed Chickadee**

Seen at every collecting station east of the British Columbia-Alaska boundary line. Near Telegraph Creek, the last week in May and the first week in June, those seen were quiet and unobtrusive, and doubtless there were many more pairs nesting in the general vicinity than appeared to be the case from the few we saw. A nest found near Telegraph Creek contained nine young, about ready to leave on June 14. At Glenora, during the first week in July, full-grown young were collected, from flocks formed by the junction of two, sometimes of three, families. Encountered at Doch-da-on Creek and certainly nesting there, but not so abundant as farther up the river. At Flood Glacier there were a few of the birds about, but it seems unlikely that they had nested there. We were not at that station at the proper season to definitely ascertain this, but the woods are not of the character that is most favored by this chickadee; there are no poplars at all, the forest is, for the most part, of conifers with but a few cottonwoods, and is dense and dark. Where the long-tailed chickadee appears to be most at home is in rather open and sunny poplar woods.

Several small flocks were seen at Great Glacier, August 9 to 16, but again it does not seem likely that the species had been nesting there. The Great Glacier is only about ten miles from the British Columbia-Alaska boundary, so that it is probable that the long-tailed chickadee occurs at times quite to the mouth of the river.

The nest discovered near Telegraph Creek was in a tract of rather open woods, mostly of small poplars. It was in a dead poplar stub about three inches in diameter, a mere shell of dead and decayed wood, hardly strong enough to hold the tightly packed and rapidly growing young, who did actually break through the wall at one place. The entrance hole was five inches from the base, the nest itself, flush with the ground. The lining appeared to be entirely of matted moose hair.

Both parents carried food to the nest assiduously after foraging expeditions that lasted from two to five minutes. In approaching the nest, the old birds came through the trees and bushes until within

about eight or ten feet of their destination; then they dropped to the ground and hopped to the entrance. To the casual observer they disappeared at a point some distance from the nest, and it was not until they had been observed for some time that this subterfuge was detected. The staple food that was being brought to the young was a small green caterpillar infesting the poplars at that time; also a white grub, a green katydid, and many mosquito-like insects.

Thirty specimens were collected (nos. 40235-40264), six adults, eighteen in juvenal plumage, and six in various stages of the molt from juvenal to first winter plumage. Two of the latter category, from Great Glacier, August 12, have nearly finished the change. The birds of this series, in color and size, exhibit the characters ascribed to the subspecies *septentrionalis*, that is, as regards differentiation from the eastern *atricapillus*. Within the rather extensive habitat of *septentrionalis* there appears to be some variation in color, perhaps enough to separate the Stikine River birds as distinguishably darker colored than typical *septentrionalis*. A few specimens at hand from the middle west suggest this possibility, but there is not enough material available to verify the supposition. The buffy coloration on the sides and flanks appears to be an extremely evanescent character, conspicuously present in the fresh fall plumage, but absent in breeding adults (in which this same plumage has been subject to several months of wear). In very young birds (nestlings) it is strongly apparent, but in juvenals that could have been out of the nest no more than a month it has almost entirely vanished.

***Penthestes gambeli abbreviatus* Grinnell. Short-tailed Mountain  
Chickadee**

The limited opportunities we had for observation of this bird did not suffice to demonstrate its ecological relationships with *P. atricapillus septentrionalis*. That is, as regards choice of local habitats of the two—an interesting point where two such closely related species of one genus occur in the same general region. *Septentrionalis*, as previously remarked, strongly favors the poplar woods, and other subspecies of the species *atricapillus* are known as denizens of deciduous forests elsewhere. The species *gambeli*, on the other hand, is largely an inhabitant of coniferous woods, and it seems likely that in the Stikine region *P. gambeli abbreviatus* makes its summer home amid the spruce and balsam of the higher mountain slopes, where we never encountered *P. atricapillus septentrionalis*. At Doch-da-on

Creek, at the end of the nesting season, small flocks of *P. gambeli abbreviatus* were seen on several occasions; it was observed nowhere else. Five specimens were collected (nos. 40265–40269), four on July 14 in woods at the river's edge, and one on July 23, on a mountain slope at about 3000 feet elevation, close to timber line. The series consists of two adults in extremely worn plumage, and three in juvenal plumage. Oberholser (1919b, p. 424) has reported the occurrence of this subspecies at Thudade Lake, British Columbia. The present point of record is about two hundred miles northwest of Thudade Lake, and, in a direct line, about sixty miles from the coast. It must indicate about the extreme northwestern limit reached by this bird. For the use of the name *Penthestes gambeli abbreviatus* see Grinnell, 1918, p. 510.

***Penthestes rufescens rufescens* (J. K. Townsend).** Chestnut-backed Chickadee

A number of small flocks seen in the dense spruce woods at Flood Glacier. The occurrence of this common coastal species at that point implies its continuous distribution along the river below that station. That we did not meet with it at Great Glacier and Sergief Island was probably fortuitous. Nine specimens were collected at Flood Glacier on dates ranging from July 31 to August 7, all young birds in juvenal plumage (nos. 40270–40278).

***Regulus satrapa olivaceus* Baird.** Western Golden-crowned Kinglet

Very few kinglets were seen anywhere. From May 27 to June 4 several of the present species, apparently migrants, were observed at different times along the trail from Telegraph Creek to the Summit. Our failure to find the species subsequently may, perhaps, have been because the birds were breeding in the spruce timber of the higher mountain slopes, to which we made but few visits. Several times I thought I heard the sibilant call note of the golden-crowned kinglet in some dense timber above Doch-da-on Creek (at about 3000 feet altitude), in July, but I was unable to see the birds. At Flood Glacier, August 7, one was seen in a mixed flock of migrating small birds, and there may have been others passing through at the time. Two specimens were collected during the summer, an adult male at the Junction, May 27 (no. 40279), and an adult female at Flood Glacier (no. 40280).

***Regulus calendula calendula* (Linnaeus). Ruby-crowned Kinglet**

Occurred in about the same manner as the golden-crowned kinglet. A few were seen between Telegraph Creek and the Summit during the last week in May and the first week in June. Then on July 18 an adult female was collected on a mountain slope near Doch-da-on Creek, at about 4000 feet altitude, presumably upon its nesting ground. This bird (no. 40281) is in very worn plumage, but, even so, there is no doubt that it does not belong to the coastal subspecies, *R. calendula grinnelli*. It is of a paler colored race of the interior. Whether or not this is the same as the ashy colored subspecies, *R. c. cineraceus*, of the mountains of California, the material at hand does not suffice to determine.

***Regulus calendula grinnelli* W. Palmer. Sitka Kinglet**

A few migrating ruby-crowned kinglets were seen at Great Glacier on August 10, 11, and 13, and four specimens were collected (nos. 40282-40285). At Sergief Island a single bird was seen on September 1. The four obtained are all young birds molting from juvenal into first winter plumage. They are clearly of the subspecies *grinnelli*.

***Myadestes townsendi* (Audubon). Townsend Solitaire**

Fairly common at low altitudes in the upper Stikine Valley. There were at least three pairs nesting within half a mile of the town of Telegraph Creek, and others were seen down the river as far as Doch-da-on Creek. The solitaires had already reached the region when we arrived, on May 23; in fact, nesting activities must have been well under way by that time. On June 7 a nest was found containing five eggs, just hatching; the next morning it held three young birds. Two of the eggs were apparently not fertile. This nest, close to town and by the side of a road we traversed almost daily, was kept under observation until the family departed. On the morning of June 20 the young were gone, having left since the previous evening.

The nest was placed under the overhanging bank on the upper side of a wood road. The slope was south facing and the nest well exposed to the sun's rays. This exposure, advantageous as far as warmth was concerned, placed the bulky structure conspicuously in view of anyone passing along the road, for there was no concealing vegetation on the bare, dirt bank.

A second nest, in a somewhat similar situation, was discovered, unfinished, on June 8. Both birds were around at that time, but they deserted this home before any eggs were laid.

The solitaires did not sing much but the call note was uttered continually. From our rooms in town at Telegraph Creek, this was one bird note that could be heard hour after hour, monotonously repeated nearly the whole day through. To our ears it sounded so nearly like the distant barking of a California ground squirrel (*Citellus beecheyi*) that the sound would surely have been disregarded as a bird call had we been in a region where the squirrels occur.

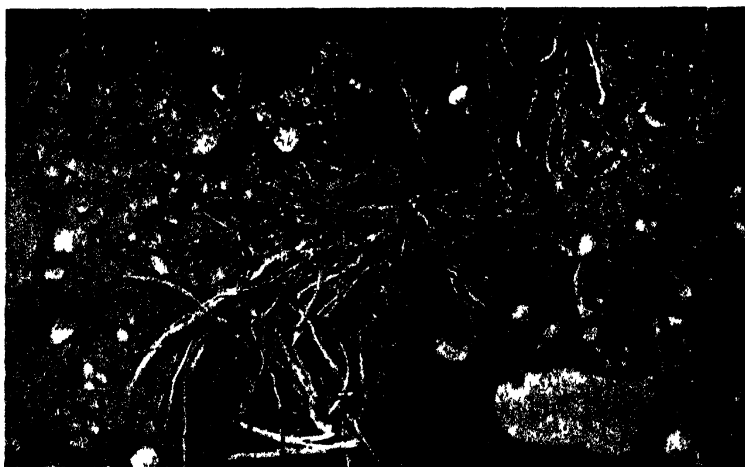


Fig. FF. Townsend solitaire (*Myadestes townsendi*) on nest. This nest was placed in a cut bank at the side of a road, a southern exposure that received the full benefit of the sun's rays. Photograph taken near Telegraph Creek, June 9, 1919.

At Glenora, early in July, and at Doch-da-on Creek, toward the end of the same month, solitaires were seen at intervals, single birds, and apparently migrating, though nearly all that were seen were still in the juvenal plumage. While none was observed by us any farther down the river, the capture of one at Wrangell on April 30, 1919, by E. P. Walker (no. 41286) indicates the possible occurrence of the species at any point in the Stikine Valley during the migrations.

Two specimens were collected, a male and a female, both in juvenal plumage, taken at Glenora on July 5 and 7, respectively (nos. 40286, 40287). Compared with Californian birds at the same stage, the Stikine River specimens show some difference in coloration. The ground color

of the upper parts in the northern birds is appreciably more gray, less buffy, and the spots are less yellowish. We obtained no adults, but the Wrangell adult, above mentioned, and others from the Rocky Mountain region farther south are not perceptibly different from the Californian birds. The differences seen in the juvenals may be significant, but our material is not sufficient to demonstrate the fact.

***Hylocichla ustulata ustulata* (Nuttall). Russet-backed Thrush**

There were a very few individuals of this species still lingering in the region when we arrived at the mouth of the Stikine River, about the middle of August. One was seen on Sergief Island, August 18, and another on September 4, both in the alder thickets that surrounded our camp. As neither one was taken, it is, of course, possible that the birds seen were of the subspecies *swainsoni*, rather than *ustulata*. Our experience on the Stikine disclosed the presence of *swainsoni* so far down the river that it would not be surprising if occasional individuals should wander quite to the coast during migration. However, as Sergief Island is within the known range of *ustulata*, while *swainsoni* has never yet been taken on the coast, it is proper to refer the records from that point to the race known to occur there.

***Hylocichla ustulata swainsoni* (Tschudi). Olive-backed Thrush**

One of the commoner species of the upper Stikine Valley. First noted at the Junction on May 28; the next three days saw an influx of considerable numbers. On May 31 the first song was heard, so similar to the, to us, more familiar notes of the russet-backed thrush as to be indistinguishable. On June 5 a female was shot, with eggs beginning to enlarge in the ovary, on June 9 one was taken which had laid part of its set, and on June 12 the first set of eggs was obtained. A young bird, just out of the nest, was taken at Glenora on July 7, and full-grown juvenals were collected at Flood Glacier early in August.

This is a bird of the poplar woods and willow thickets of the lowlands, primarily, but we found it also in small numbers well up the mountain sides. On July 17 Dixon saw several at the upper edge of the spruce timber (about 4000 feet) on the mountains above Doch-da-on Creek.

Nests found were all at the lower levels. The first discovered was in fairly open woods, mostly of small willows, and in a very exposed



situation. The nest was about four feet from the ground, between four upright willow branches, and there was no concealing green growth about it. The material used was mostly dried weed stems, grass, and shreds of bark. The lining differs from the outer structure only in that it consists of finer material of the same sort. Dimensions of this nest are as follows: greatest outside diameter, 170 mm.; inside diameter, 68; outside depth, 100; inside depth, 40. It contained four eggs, partly incubated.

A second nest was collected on June 19, essentially like the first except that it is less bulky. This was in an alder, about four feet from the ground, alongside a seldom used road, and again in a most exposed situation. The set was of four eggs. On June 19 still another nest was found, in a crotch in a dead willow, about eight feet up. In this one there are more and coarser bark strips used, and a good deal of the cottony fiber from the fireweed pods. It contained five eggs. The last occupied nest was found at Doch-da-on Creek, July 21, containing three eggs nearly ready to hatch. This was in an alder, about three feet from the ground. In the case of the nest last described, the parent bird, presumably the female, was in great distress and did not go very far away. With each of the others, the sitting bird slipped unobtrusively away and did not return until some time had elapsed, probably never under twenty minutes.

At Great Glacier, August 11, a young bird was collected, not yet able to fly, that is clearly referable to *swainsoni*. This last record is of considerable interest as it carries the breeding range of *swainsoni* westward in this region to a point about thirty miles from the coast, the habitat of *Hylocichla u. ustulata*. Although the habitats of the two subspecies thus approach so closely, there is no evidence of intergradation of characters between them. In the Stikine River series of *swainsoni* there is not one specimen of an equivocal character. On the contrary, these birds, like those from the Yukon region, show an extreme of grayness; compared with typical *swainsoni* from eastern North America, that carries them farther from *ustulata* in appearance than are specimens from the Atlantic coast. (In this connection see Oberholser, 1898, p. 305.) It may be pointed out also that although *ustulata* and *swainsoni* breed in different parts of northern California, there is no section of that state that is known to be occupied by birds of intermediate character. As in the Stikine region, both occur in typical form quite to the margins of their respective habitats. Thus, if *ustulata* and *swainsoni* are to be regarded as two subspecies of one

species, it must be on the criterion of individual variation rather than on that of gradual blending through the population of contiguous territories. In the Stikine region the two forms occur, in the interior and on the coast, respectively, and within a few miles of each other, as distinct in appearance as any two species. On the other hand, as regards song, nesting habits and eggs, these features all supply evidence to show close relationships between the two. In none of these respects is there any apparent difference.

Twenty-one specimens of the olive-backed thrush were collected (nos. 40288-40308), fifteen adults and six young.

### ***Hylocichla guttata guttata* (Pallas). Alaska Hermit Thrush**

There were a few pairs nesting along Telegraph Creek to within a mile or two of the Stikine, but mostly the birds were at higher elevations. None was seen in the immediate vicinity of Glenora or of Doch-da-on Creek, but the species was encountered in spruce woods on the mountains above the latter point, at about 3000 feet altitude.

Two nests were taken. The first (no. 1827) was found on May 23, with three eggs, and collected on May 26 with a set of five. It was in the creek bottom, about two miles north of the town of Telegraph Creek, some three feet from the ground, in a spruce sapling. The nest rested against the trunk and upon some small branches. The outer structure is of twigs, weed stems, rootlets and bark strips; the lining is of fine rootlets and grass, with a good many of the long overhairs of a porcupine. It measures as follows: greatest outside diameter about 160 mm.; outside depth, 90; inside diameter, 60; inside depth, 40 mm.

The second nest (no. 1828) was taken June 4, with four slightly incubated eggs. This was found near the Junction, four miles north of Telegraph Creek, amid similar surroundings to the first one. It was placed between two small spruce trees, thirty inches from the ground. In general appearance and in details of structure, it is very similar to the first one found, even to the porcupine hairs in the lining. Both were in situations where there was little concealing vegetation, and were easily seen from some distance.

Five specimens, two males and three females, were collected between Telegraph Creek and the Summit (nos. 40309-40313). The hermit thrush of this general region has been referred to *Hylocichla guttata sequoiensis* by Ridgway (1907, p. 44); specimens from Atlin, two hundred miles north of Telegraph Creek, have been recorded as

*sequoiensis* (E. M. Anderson, 1915a, p. 17). I cannot agree with this determination, as applied to the Telegraph Creek series. These birds are not the same as the hermit thrush of the Sierra Nevada of California (*sequoiensis*). They are appreciably smaller than the latter and they are not so gray. They come very close, both in color and size, to a series of *guttata*, from Prince William Sound, Alaska, being perhaps a trifle paler colored. They are quite different in appearance from the dark colored *nanus*, of the coast region of southern Alaska.

TABLE XIII

Measurements in millimeters of *Hylocichla guttata guttata* and *Hylocichla guttata sequoiensis*

<i>Hylocichla guttata guttata</i>		Wing	Tail	Culmen	Tarsus
40312 ♂	Telegraph Creek, B. C., June 4, 1919	89	69	13	28.5
40313 ♂	Telegraph Creek, B. C., June 4, 1919	87	69.5	12	28.5
40310 ♀	Telegraph Creek, B. C., June 1, 1919	84	67	12	29
40311 ♀	Telegraph Creek, B. C., June 4, 1919	83	66	12	28.5
40309 ♀	Telegraph Creek, B. C., May 26, 1919	85	66.5	12	26.5
<i>Hylocichla guttata sequoiensis</i>					
22668 ♂	Independence, Inyo Co., Cal., May 9, 1912	94	72	14	30
22669 ♂	Kearsarge Pass, Inyo Co., Cal., June 12, 1912	97	72	14	30
22670 ♂	Kearsarge Pass, Inyo Co., Cal., June 13, 1912	97	75	13	27.5
22671 ♀	Kearsarge Pass, Inyo Co., Cal., June 15, 1912	91	70	14	30

### ***Hylocichla guttata nanus* (Audubon). Dwarf Hermit Thrush**

The hermit thrush appears to range the whole length of the Stikine Valley; it is one of the few species of which we found specimens at intermediate points the characters of which indicate a likelihood of intergradation in that region between the two unlike subspecies at the two ends of the stream. A specimen taken at Flood Glacier on July 27 (no. 40314), an adult female not yet beginning to molt, is intermediate in color between the gray Telegraph Creek specimens and the dark colored birds of the coast. Despite the lateness of the season and the consequent greater wear upon the plumage, it is still appreciably browner than the Telegraph Creek birds. On the whole, it seems best regarded as *nanus*, though not typical of that form. A young bird (no. 40315) from Great Glacier, August 11, in the juvenal plumage throughout, is referred to *nanus*.

On Sergief Island, hermit thrushes were fairly numerous up to the first week in September. One was taken on August 23, still in the juvenal plumage (no. 40316), and one on August 27, which had finished the molt into the first winter plumage (no. 40317).

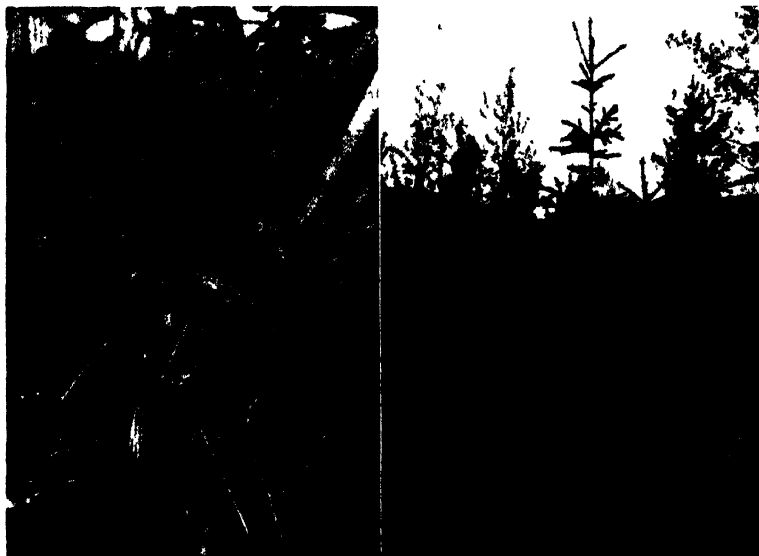


Fig. GG

Fig. HH

Fig. GG. The olive-backed thrush (*Hyllocichla ustulata swainsoni*) is a bird of the dry woods of poplar, alder, and willow, as contrasted with the hermit thrush, a denizen of coniferous woods. The nest of olive-backed thrush here shown was in a thicket of alder and willow mixed, and in all respects is typical of the species as it occurs in this region. At the time this nest was photographed (on June 19, and near Telegraph Creek) it contained four eggs.

Fig. HH. Alaska hermit thrush (*Hyllocichla guttata guttata*) standing over nest. The nest was built upon the interlaced branches of two small spruce trees, about three feet from the ground, and at the bottom of a cool, shady cañon. Photograph taken near Telegraph Creek, June 4, 1919.

### ***Planesticus migratorius migratorius* (Linnaeus). Eastern Robin**

At the time of our arrival at Telegraph Creek, robins were present in full force. They were abundant along the river and scarce at higher altitudes, but some were seen clear to the Summit. On May 30 one bird was seen carrying building material, but this must have been rather late, for young were out of the nest on June 9. Robins were fairly numerous at Glenora and at Doch-da-on Creek. By the time we reached the latter place, the middle of July, the spotted young comprised a large proportion of the birds seen.

At Flood Glacier, our next stopping place down stream, robins abruptly became very scarce. Call notes were heard on July 29, but the birds were not seen. At Great Glacier, too, there were very few around. Two seen, but not obtained, on August 11, were the only ones noted.

Nine specimens (nos. 40318-40326) were collected on the upper Stikine River, at Telegraph Creek, Glenora, and Doch-da-on Creek. The series comprises two adult males, five adult females, and two juvenals. These birds are referable to the eastern subspecies, *Planesticus migratorius migratorius*. The outer rectrices are conspicuously tipped with white, which is not the case with the coast form, *P. m. caurinus*, a differentiating character that is readily apparent, even in the live birds. The young from Telegraph Creek are of a different color from the coast birds, being less brownish and more gray, especially on the upper parts.

Just how far down the river *P. m. migratorius* extends we did not definitely ascertain, but, as noted above, robins were abundant as far down the river as Doch-da-on Creek, and abruptly became very scarce just below there. A little below Doch-da-on Creek, and from that point down, forest conditions are such that it seems doubtful that there are many robins breeding anywhere along the lower river. While we saw and heard a few at Flood Glacier and Great Glacier, we obtained no specimens, so cannot be certain which subspecies occurs at those points.

### ***Planesticus migratorius caurinus* Grinnell. Northwestern Robin**

Fairly numerous at Sergief Island, though irregularly so, during the whole of our stay at that place, August 17 to September 7. Most of the birds seen were in the midst of the molt. One specimen was preserved (no. 40327), a young female molting into first winter plumage. *Planesticus migratorius caurinus* Grinnell (1909b, p. 241) has been refused recognition by the A. O. U. Committee (1909, p. 302), but nevertheless it seems to me a sufficiently distinct subspecies. Additional material acquired since the Committee's action is all corroborative of the describer's diagnosis. (Cf. Swarth, 1912, p. 81; Oberholser, 1917a, p. 195.)

***Ixoreus naevius naevius* (Gmelin). Varied Thrush**

Seen on Sergief Island at various times during our stay there (August 17 to September 7). The subspecies is, of course, a summer visitant and reasonably abundant throughout the coast region of southeastern Alaska. One specimen was collected (no. 40332), a young male, just beginning to molt into first winter plumage.

***Ixoreus naevius meruloides* (Swainson). Northern Varied Thrush**

There were no varied thrushes in the immediate vicinity of Telegraph Creek, nowhere in the river valley at least. We were constantly on the lookout for them, and both the birds and the call notes are sufficiently conspicuous to be readily detected by any one familiar with the species. Subsequent experience farther down the river leads me to believe that they probably breed at higher altitudes throughout the region; we ourselves, found them at but one such station.

At Glenora, early in the morning of July 1, the call note of a varied thrush was heard distinctly, several times repeated. The bird was in thick shrubbery at the river's edge, and could not be seen. It was assumed to be a wandering individual, finished with family cares and straying from the breeding ground on the nearby mountains. On July 11 a male varied thrush was seen on the mountain side above Doch-da-on Creek, at about 3000 feet altitude. The bird was perched high on a dead spruce stub, a hundred feet or more above the ground, uttering at frequent intervals the disconnected notes comprising the song of this species. Later on others were seen or heard at about the same elevation.

On July 18 a young bird was seen at the level of the Stikine River, at Doch-da-on Creek, and from then on a few others were observed from time to time. There were a few in the woods at Flood Glacier and at Great Glacier, exceedingly wary and most difficult to see. Three specimens were collected at Flood Glacier (nos. 40328-40330), an adult male and two juvenal females; and one at Great Glacier, an adult female (no. 40331). These birds are all referable to the interior subspecies, *Ixoreus n. meruloides*.

***Sialia currucoides* (Bechstein). Mountain Bluebird**

There were two or three pairs in the town of Telegraph Creek, presumably nesting about some of the buildings. A few others were seen within a radius of ten or twelve miles, usually around small clearings, where there had been some attempt at cultivation of the ground, or in burnt-over areas, where fire had swept away most of the large timber.

Two nests were found. On June 14 a set of four eggs (no. 1829), about half incubated, was taken. The nest was in an old woodpecker hole in a dead birch stub, eight feet from the ground. This was near the shore of Sawmill Lake, on a slope that had been lumbered and burnt over, so that it was nearly cleared of large trees. A second nest was found in another birch stub nearby, a trunk that was occupied by a pair of tree swallows, as well as the bluebirds. This nest on June 17 contained four newly hatched young and one egg about ready to hatch.

Curiously, no bluebirds were seen near Glenora, though the open fields and old houses were features that should have attracted them, and the species undoubtedly does occur thereabout at times. On July 23 a small flock was seen at timber line, about 4000 feet altitude, above Doch-da-on Creek, apparently the beginning of the migratory movement at the close of the nesting season. I have seen specimens of the mountain bluebird taken at the mouth of the Stikine River on April 10, 1919, in migration, by E. P. Walker.

Ten specimens preserved (nos. 40333-40342), three adult males, three adult females, and four newly hatched young preserved in alcohol.

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BIRDS AND MAMMALS OF THE SKEENA  
RIVER REGION OF NORTHERN  
BRITISH COLUMBIA

BY  
HARRY S. SWARTH

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# BIRDS AND MAMMALS OF THE SKEENA RIVER REGION OF NORTHERN BRITISH COLUMBIA

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HARRY S. SWARTH

(Contribution from the Museum of Vertebrate Zoology of the University of California)

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## INTRODUCTION

In pursuance of the plan of zoological exploration which the Museum of Vertebrate Zoology, since its inception, has had under way in northwestern North America, a field trip was made into that region during the summer of 1921. The expenses of this trip, as of the preceding ones, were defrayed by Miss Annie M. Alexander, whose interest in the zoology of the northwest was the determining factor in directing the activities of the Museum toward that part of North America. The locality chosen for the 1921 expedition was the valley of the upper Skeena River, northern British Columbia, centering at the town of Hazelton. Our party consisted of two, the writer and one assistant, Mr. William Duncan Strong, a student at the University of California. The material collected consists of 265 mammals, 687 birds, and 50 reptiles and amphibians.

Acknowledgments are due to several institutions and individuals for aid, both in prosecution of the field work and in the subsequent studies of the material collected. From the Dominion Parks Branch, Department of the Interior, Canada, and from the Game Conservation Board of British Columbia, Vancouver, permission was received to



collect birds. I am under obligations to the Bureau of Biological Survey of the United States Department of Agriculture, through its chief, Dr. E. W. Nelson, for the loan of specimens and for the identification of certain mammals. To the Victoria Memorial Museum, Ottawa, through Mr. P. A. Taverner, ornithological curator, and to the Provincial Museum, Victoria, British Columbia, through the director, Mr. F. Kermode, I am indebted for the loan of many specimens.

To Major Allan Brooks, of Okanagan Landing, British Columbia, I am under obligations for the loan of specimens, and for critical comments and advice bearing upon my treatment of various species of birds and mammals. Major Brooks also made the drawing of the tail of the rock ptarmigan that is shown herewith.

Plant names used in this report were kindly supplied by Professor W. L. Jepson, of the University of California, based upon specimens collected.

In treating the birds the nomenclature used is that of the American Ornithologists' Union *Check-List* (1910) and its supplements (1912, 1920), with such modifications as I employed in my "Birds and Mammals of the Stikine Region" (1922, p. 127).

## ITINERARY AND DESCRIPTIONS OF LOCALITIES

We reached Hazelton the evening of May 25. On June 20 we removed to Kispiox Valley, twenty-three miles north of Hazelton. On July 15 return was made to Hazelton, and several days devoted to packing specimens and preparing for a mountain trip. On July 21 we ascended Nine-mile Mountain. On August 14 we returned to Hazelton, and on August 16 to Kispiox Valley. Final return to Hazelton was made on September 17; on September 19 Strong took the train for home, and on September 26 the writer took his departure.

### HAZELTON

The town of Hazelton is at the junction of the Skeena and Bulkley rivers. The railroad station (Grand Trunk Pacific R. R.), some two miles to the southeast, is 177 miles from the coast, at Prince Rupert, and 973 feet above the sea. The town is in the low bottom lands through which the rivers flow. On either side of these bottom lands steep bluffs rise, two hundred feet or more, above which the higher

plateau slopes gently upward toward the several nearby mountain ranges. The most conspicuous of these, the towering, rocky peaks of the Rocher Déboulé, ten or twelve miles to the southeast, rise precipitously to elevations of more than 8000 feet.

In the bottom lands poplar (*Populus tremuloides*) is the dominant forest growth, covering many square miles in almost pure stands of dense woods. Along the river there are rows of large cottonwoods, and on the ridges thickets of hazel, the abundance of which probably gave the town its name.

The higher slopes and plateaus, above the river bottoms, were once thickly covered with Engelmann spruce (*Picea engelmanni*), but these areas, at least toward the southeast, have suffered repeatedly from forest fires, so that but remnants of the woods remain standing. The ground beneath is strewn with charred trunks, hidden during the summer months by fire weed and bracken; and partly burned trees remain erect at scattered intervals. The plateau region is drained by numerous small streams, bordered with thickets of willow and alder. At rather frequent intervals there are muskegs, usually unaffected by fire, and affording contrast in several respects to their more monotonous surroundings.

These muskegs, often roughly circular in shape, are of varying size, marshy, with deep, sticky mud, or sometimes a few inches of water, and with mud and water usually concealed by grass. Scattered over them are a few funereal black spruces (*Picea mariana*), festooned with streamers of black moss. The bordering forest of Engelmann spruce usually forms a ring of denser growth than elsewhere about the margin of the muskeg, where, with the spruce, are mingled a few red cedars (*Thuja plicata*).

Toward the base of Rocher Déboulé, there are places where red cedar grows in some abundance. Mostly these trees had been cut out years before, but some groves remain, and in these clumps of cedars and in the muskegs species of birds are breeding that are not seen elsewhere at the same altitude.

Our camp in this region was on the opposite side of the Bulkley River from Hazelton, on what is locally known as Mission Point. Mammal trapping was carried on in the bottom lands between the Bulkley River and the railroad.

## KISPIOX VALLEY

The Kispiox River empties into the Skeena about ten miles north of Hazelton. Our camp in Kispiox Valley was at Beirnes' ranch, twenty-three miles north of Hazelton. The whole valley at that point is of much the same nature as the bottom lands near Hazelton; there is no such extent of spruce forest as is seen in the burned-over areas toward Rocher Déboulé. The forest is mainly of poplar, large sized trees with the dense underbrush that accompanies this growth. Scattered spruces occur everywhere, sometimes little clumps of them, but no extensive stands. Lodgepole pine also occurs in limited amount. In the lower Kispiox Valley there are large areas occupied almost solidly with this pine, small trees in dense groves. The region we covered in Kispiox Valley, though all in the poplar-grown bottom lands, offered a greater variety of conditions locally than is usually the case in this environment. There are many clearings in the woods, mostly pertaining to small ranches that have been abandoned. Along the river are wide expanses of open fields and pastures, some of this cleared land, some of it marshy stretches supporting no growths larger than thickets of willow and spiraea. Many little streams intersect forests and fields, some of these rivulets heading from small lakes buried in the thick woods.

Along the Kispiox River are occasional groves of cottonwood, huge trees, in stands covering large areas, with underbrush beneath that is of a different nature from that in the more open poplar woods. The sun scarcely penetrates into the depths of the cottonwood groves and the gloom of their shade is suggestive of the dark woods on the coast. Rank grass, tall nettles, thimble-berry thickets, and devil's-club combine to form a tangle that can be penetrated at but few places.

There is an abundance of berry-bearing shrubs throughout the valley. Twin-berry (*Lonicera involucratum*), dogwood (*Cornus pubescens*), kinnikinnick (*Arctostaphylos uva-ursi*), and high bush cranberry (*Viburnum pauciflorum*) are among the most conspicuous. Thickets of hazel (*Corylus rostrata*) form a large percentage of the underbrush.

## NINE-MILE MOUNTAIN

This mountain lies a short distance northeast of Hazelton; its southern base is skirted by the Babine trail, leading from the town. Our camp near the summit was about twenty miles, by road and by trail, northeast of Hazelton. In ascending the mountain, the poplar belt is left behind almost at the very base, and a forest of spruce, intermingled with cedar, is entered. At an altitude of about 2000 feet the lower edge of hemlock (*Tsuga heterophylla*) is reached; at about 2500 feet the forest is practically all hemlock, large trees, with little or no underbrush beneath. Just below timber line (about 4500 feet altitude) the forest is largely composed of white fir (*Abies grandis*), though some hemlock persists to the upper limit of tree growth.

We camped at timber line in a cabin precariously clinging to a little niche on the steep hillside. The slope was part of a huge amphitheater, the outstanding ridges on either side perhaps a mile apart, and the crest of the mountain about five hundred feet above. Immediately below was the dark hemlock and fir forest, its upper edge as sharply defined as though the open slopes above had been cleared by man. Much of this amphitheater was covered with tall grass, veratrum, and lupine; in places there were extensive thickets of alder. Wide rock slides extended down from the divide in several places, sometimes into the forests below. The trail to the top passed through a notch in the ridge at an altitude of about 5000 feet; rounded summits arose on either side about 500 feet higher. The summit of the mountain is composed of two converging ridges, each five or six miles long at least; we did not cover their entire area. Between these ridges is enclosed a broad, steeply sloping valley.

The country above timber line, covering many miles along the higher ridges, is open and park-like, very attractive to the view. White fir and mountain hemlock (*Tsuga mertensiana*) occur, dwarfed and prostrate, forming scattered thickets over ground that otherwise is mostly grass covered. Snow banks persist through the summer, and below the melting snow are occasional little lakes, sometimes an acre or more in extent. On damp slopes grass is replaced by false heather (*Cassiope mertensiana*), luxuriant growths that cover extensive areas. Below the ridges the grass became much higher and was intermingled with lupine.

An interesting feature of the Nine-mile Mountain avifauna is the unusual number of genera and species of grouse that occur there. At

the base of the mountain is the ruffed grouse (*Bonasa*) extending from the poplars below well up into the spruce and cedar woods. In the hemlock belt, upward to the tree limit, the Franklin grouse (*Canachites*) occurs. Just below timber line, and even in thickets above, is the Fleming grouse (*Dendragapus*). On the Alpine-Arctic ridges three species of ptarmigan (*Lagopus*) are found. For six species of grouse to occur so nearly in the same place is, I believe, very unusual.

#### ZONAL AND FAUNAL POSITION OF THE UPPER SKEENA VALLEY

The upper Skeena Valley lies to the eastward of the coast ranges, and its fauna and flora, as a whole, are of the interior, not of the coast. Conditions in many respects are similar to those of the upper Stikine Valley (see Swarth, 1922, p. 141), two hundred miles to the northward, and observations in the Skeena Valley tend to corroborate conclusions reached in studies of the more northern region (Swarth, *loc. cit.*). The Skeena Valley is much more humid than the upper Stikine, and neither in animal nor plant life is it so sharply contrasted with the coastal region. The more southern coast ranges are not so high and precipitous as the northern mountains, and the gap through which the Skeena reaches the coast is broad, with sloping walls. Coastal rains often drift inland up the Skeena Valley, and cloudy skies are frequent. Certain coastal species of birds extend inland here much farther than they do along the Stikine.

The upper Skeena Valley, like the Stikine, is in the Canadian life zone, contrasted with the Hudsonian zone of the seacoast (see Swarth, 1922, p. 149). Study of the list of birds breeding in the lowlands of the Hazelton region discloses many that are not found on the coast; mostly these are species that elsewhere occur in zones lower than Hudsonian. Some conspicuous ones are:

*Bonasa u. umbelloides*  
*Phloeotomus p. picinus*  
*Nuttallornis borealis*

*Empidonax t. alnorum*  
*Empidonax hammondi*  
*Piranga ludoviciana*

Certain species were seen about Hazelton that are usually found in lower zones even than the Canadian. These are:

*Tyrannus tyrannus*  
*Stelgidopteryx serripennis*  
*Vireosylva olivacea*

*Dumetella carolinensis*  
*Troglodytes a. parkmani*

There are, it is true, a number of birds found at sea level on the coast and in the lowlands of the Hazelton region, represented either by the same species or subspecies in both places, or by closely related subspecies, but these are mostly wide-ranging forms, not closely confined within any particular zone. Some such species are:

<i>Ceryle a. caurina</i>	<i>Melospiza l. lincolni</i>
<i>Spinus p. pinus</i>	<i>Hirundo erythrogaster</i>
<i>Melospiza m. morphna</i>	<i>Planesticus m. migratorius</i>

There are eighteen such cases.

Turning now to conditions at high altitudes, we find the following birds in summer at timber line (Hudsonian Zone) on Nine-mile Mountain:

<i>Dendragapus o. flemingi</i>	<i>Nannus h. pacificus</i>
<i>Canachites franklini</i>	<i>Certhia f. occidentalis</i>
<i>Perisoreus c. canadensis</i>	<i>Sitta canadensis</i>
<i>Loxia leucoptera</i>	<i>Penthestes g. abbreviatus</i>
<i>Zonotrichia coronata</i>	<i>Penthestes h. columbianus</i>
<i>Passerella i. annectens</i>	<i>Regulus s. olivaceus</i>
<i>Dendroica townsendi</i>	<i>Regulus c. calendula</i>
<i>Wilsonia p. pileolata</i>	<i>Hylocichla g. guttata</i>
	<i>Ixoreus n. naevius</i>

Of these seventeen species, just four (*Perisoreus c. canadensis*, *Zonotrichia coronata*, *Penthestes g. abbreviatus*, and *Penthestes h. columbianus*) are not found upon the coast. The others, represented either by the same species or by closely related complementary subspecies, are mostly common and characteristic birds of the forests at sea level in the coastal region. In general, the avifauna at sea level on the coast is thus seen to be closely similar to that found just below timber line (4500 feet altitude), two hundred miles inland.

It is of interest to note that muskeg surroundings in the valleys of the upper Skeena region produced certain birds usually found in the Hudsonian Zone. Occasional pairs, at wide intervals, were thus noted of the following species:

<i>Picoides arcticus</i>	<i>Regulus s. olivaceus</i>
<i>Picoides a. fasciatus</i>	<i>Regulus c. calendula</i>
<i>Sitta canadensis</i>	<i>Ixoreus n. naevius</i>

On the treeless summit of Nine-mile Mountain the following birds were found breeding:

<i>Lagopus l. alexandrae</i>	<i>Leucosticte t. littoralis</i>
<i>Lagopus rupestris</i>	<i>Passerculus s. alaudinus</i>
<i>Lagopus l. leucurus</i>	<i>Anthus rubescens</i>
<i>Otocoris a. arcticola</i>	

Lack of suitable open country elsewhere may be an element in the occurrence of a horned lark and a Savannah sparrow as Alpine-Arctic species in this region, but the other species listed are all representative inhabitants of the Alpine-Arctic Zone.

Results of this classification of the birds by their zonal predilections may be summarized as follows: that the valleys of the upper Skeena region, east of the coast ranges, are in the Canadian life zone; that on the surrounding mountains there is a well defined belt of Hudsonian Zone; and that the treeless mountain tops pertain to the Alpine-Arctic Zone. At this latitude the Canadian life zone does not reach the coast, where but two life zones can be defined, Hudsonian from sea level upward to the tree limit, and Alpine-Arctic above that.

An analysis of the occurrence of mammals in this general region, as far as our more limited knowledge of them extends, tends to corroborate the above statements based upon the avifauna.

The upper Skeena Valley is the northern limit reached in this region by the following species of birds:

<i>Phloeotomus p. picinus</i>	<i>Bombycilla cedrorum</i>
<i>Tyrannus tyrannus</i>	<i>Vireosylva olivacea</i>
<i>Hesperiphona v. brooksi</i>	<i>Dendroica a. auduboni</i>
<i>Zonotrichia albicollis</i>	<i>Dendroica magnolia</i>
<i>Junco o. shufeldti</i>	<i>Dumetella carolinensis</i>
<i>Stelgidopteryx serripennis</i>	<i>Troglodytes a. parkmani</i>

Some of these get no farther north than the town of Hazelton. Of the others, it is doubtful if favorable conditions occur for more than fifty or sixty miles north of that point, at the outside. There are enough of these southern species to give character to the avifauna of this region, they all are stopped at practically the same boundary, and some have closely related congeners in the country immediately to the northward (see Swarth, 1922, p. 152).

Besides the species of mammals collected, certain others came to our attention. Tracks of black bear (*Ursus americanus*) appeared along the rivers in September when the salmon were dying. Coyotes (*Canis*), though never seen, were frequently heard howling in Kispiox Valley. Beaver (*Castor canadensis*) were actively at work in certain small lakes near our Kispiox Valley camp. Fresh tracks of deer (*Odocoileus*) were noted at the summit of Nine-mile Mountain, and a single deer was seen in Kispiox Valley, September 8. A number of shed horns of caribou (*Rangifer*) were found on Nine-mile Mountain, but the animals themselves were not there at that time.

## CHECK LIST OF THE BIRDS

1. *Colymbus holboelli* (Reinhardt).
2. *Gavia immer* (Brünnich).
3. *Larus brachyrhynchus* Richardson.
4. *Mergus americanus* Cassin.
5. *Anas platyrhynchos* Linnaeus.
6. *Mareca americana* (Gmelin).
7. *Nettion carolinense* (Gmelin).
8. *Dafla acuta* (Linnaeus).
9. *Anser albifrons* (Scopoli), subsp.?
10. *Branta canadensis* (Linnaeus), subsp.?
11. *Botaurus lentiginosus* (Montagu).
12. *Ardea herodias* Linnaeus, subsp.?
13. *Gallinago delicata* (Ord).
14. *Pisobia bairdi* (Coues).
15. *Pisobia minutilla* (Vieillot).
16. *Ereunetes mauri* Cabanis.
17. *Tringa solitaria cinnamomea* (Brewster).
18. *Bartramia longicauda* (Bechstein).
19. *Actitis macularia* (Linnaeus).
20. *Dendragapus obscurus flemingi* Taverner.
21. *Canachites franklini* (Douglas).
22. *Bonasa umbellus umbelloides* (Douglas).
23. *Lagopus lagopus alexandrae* Grinnell.
24. *Lagopus rupestris* (Gmelin), subsp.?
25. *Lagopus leucurus leucurus* (Swainson).
26. *Circus hudsonius* (Linnaeus).
27. *Accipiter velox* (Wilson).
28. *Astur atricapillus atricapillus* (Wilson).
29. *Astur atricapillus striatulus* Ridgway.
30. *Buteo borealis calurus* Cassin.
31. *Buteo swainsoni* Bonaparte.
32. *Aquila chrysaetos* (Linnaeus).
33. *Haliaeetus leucocephalus alascanus* C. H. Townsend.
34. *Falco columbarius columbarius* Linnaeus.
35. *Falco columbarius suckleyi* Ridgway.
36. *Falco sparverius sparverius* Linnaeus.
37. *Pandion haliaetus carolinensis* (Gmelin).
38. *Bubo virginianus lagophonus* (Oberholser).
39. *Ceryle alcyon caurina* Grinnell.
40. *Dryobates villosus monticola* Anthony.
41. *Dryobates pubescens leucurus* (Hartlaub).
42. *Picoides arcticus* (Swainson).
43. *Picoides americanus fasciatus* Baird.
44. *Sphyrapicus varius ruber* (Gmelin).
45. *Phloeotomus pileatus picinus* Bangs.
46. *Colaptes auratus borealis* Ridgway.
47. *Chordeiles virginianus virginianus* (Gmelin).
48. *Cypseloides niger borealis* (Kennerly).
49. *Chaetura vauxi* (J. K. Townsend).



50. *Selasphorus rufus* (Gmelin).
51. *Tyrannus tyrannus* (Linnaeus).
52. *Sayornis sayus yukonensis* Bishop.
53. *Nuttallornis borealis* (Swainson).
54. *Myiochanes richardsoni richardsoni* (Swainson).
55. *Empidonax trailli alnorum* Brewster.
56. *Empidonax hammondi* (Xantus).
57. *Empidonax wrighti* Baird.
58. *Otocoris alpestris arcticola* Oberholser.
59. *Cyanocitta stelleri annectens* (Baird).
60. *Perisoreus canadensis canadensis* (Linnaeus).
61. *Corvus brachyrhynchos hesperis* Ridgway.
62. *Agelaius phoeniceus arctolegus* Oberholser.
63. *Euphagus carolinus* (Müller).
64. *Hesperiphona vespertina brooksi* Grinnell.
65. *Carpodacus purpureus purpureus* (Gmelin).
66. *Loxia leucoptera* Gmelin.
67. *Leucosticte tephrocotis littoralis* Baird.
68. *Spinus pinus pinus* (Wilson).
69. *Calcarius lapponicus alascensis* Ridgway.
70. *Calcarius pictus* (Swainson).
71. *Calcarius ornatus* (J. K. Townsend).
72. *Passerculus sandwichensis alaudinus* Bonaparte.
73. *Zonotrichia leucophrys gambeli* (Nuttall).
74. *Zonotrichia coronata* (Pallas).
75. *Zonotrichia albicollis* (Gmelin).
76. *Spizella monticola ochracea* Brewster.
77. *Spizella passerina passerina* (Bechstein).
78. *Junco hyemalis hyemalis* (Linnaeus).
79. *Junco hyemalis connectens* Coues.
80. *Junco oreganus shufeldti* Coale.
81. *Melospiza melodia morphna* Oberholser.
82. *Melospiza lincolni lincolni* (Audubon).
83. *Passerella iliaca iliaca* (Merrem).
84. *Passerella iliaca altivagans* Riley.
85. *Piranga ludoviciana* (Wilson).
86. *Hirundo erythrogaster* Boddaert.
87. *Iridoprocne bicolor* (Vieillot).
88. *Tachycineta thalassina lepidia* Mearns.
89. *Stelgidopteryx serripennis* (Audubon).
90. *Bombycilla garrula pallidiceps* Reichenow.
91. *Bombycilla cedrorum* Vieillot.
92. *Vireosylva olivacea* (Linnaeus).
93. *Vireosylva gilva swainsoni* (Baird).
94. *Vermivora celata celata* (Say).
95. *Vermivora celata lutescens* (Ridgway).
96. *Vermivora peregrina* (Wilson).
97. *Dendroica aestiva rubiginosa* (Pallas).
98. *Dendroica coronata hooveri* McGregor.
99. *Dendroica auduboni auduboni* (J. K. Townsend).
100. *Dendroica magnolia* (Wilson).
101. *Dendroica striata* (J. R. Forster).

102. *Dendroica townsendi* (J. K. Townsend).
103. *Seiurus noveboracensis notabilis* Ridgway.
104. *Oporornis tolmiei* (J. K. Townsend).
105. *Geothlypis trichas occidentalis* Brewster.
106. *Wilsonia pusilla pileolata* (Pallas).
107. *Setophaga ruticilla* (Linnaeus).
108. *Anthus rubescens* (Tunstall).
109. *Dumetella carolinensis* (Linnaeus).
110. *Troglodytes aëdon parkmani* Audubon
111. *Nannus hiemalis pacificus* (Baird).
112. *Certhia familiaris occidentalis* Ridgway.
113. *Sitta canadensis* Linnaeus.
114. *Penthestes atricapillus septentrionalis* (Harris).
115. *Penthestes gambeli abbreviatus* Grinnell.
116. *Penthestes hudsonicus columbianus* (Rhoads).
117. *Penthestes rufescens rufescens* (J. K. Townsend).
118. *Regulus satrapa olivaceus* Baird
119. *Regulus calendula calendula* (Linnaeus).
120. *Myadestes townsendi* (Audubon).
121. *Hylocichla ustulata swainsoni* (Tschudi).
122. *Hylocichla guttata guttata* (Pallas).
123. *Hylocichla guttata pallasi* (Cabanis).
124. *Planesticus migratorius migratorius* (Linnaeus).
125. *Ixoreus naevius naevius* (Gmelin).
126. *Ixoreus naevius meruloides* (Swainson).
127. *Sialia currucoides* (Bechstein).

## GENERAL ACCOUNTS OF THE BIRDS

### *Colymbus holboelli* (Reinhardt). Holboell Grebe

An adult male (no. 41986), taken in the Bulkley River at Hazelton, September 18, was the only one seen during the summer.

### *Gavia immer* (Brünnich). Common Loon

There seemed to be a pair of loons to each of the many little lakes scattered through the woods. The birds were frequently seen circling about overhead, calling as they flew. Toward the end of summer several might be in sight at once, going through such maneuvers.

### *Larus brachyrhynchus* Richardson. Short-billed Gull

An immature male (no. 41987) was shot July 31 near the summit of Nine-mile Mountain, at about 5500 feet altitude. There were several small, snow-bordered lakes nearby, but otherwise nothing in the surroundings that might be thought attractive to gulls.

In late August and September, when the salmon run was drawing to a close, many gulls were seen along the rivers. None was collected, but the birds observed were mostly of some species larger than *brachyrhynchus*.

***Mergus americanus* Cassin. American Merganser**

Breeding in Kispiox Valley; adults occasionally flushed from streams and sloughs, and several broods of young encountered. On June 28 a female with eleven ducklings appeared in the swift-flowing creek by our camp, the young still mostly down-covered.

***Anas platyrhynchos* Linnaeus. Mallard**

Breeding in Kispiox Valley. A nest with eggs was reported by an acquaintance, found about the middle of June in a hayfield. We saw single birds at various times during June and July. Toward the end of August there was an influx of migrating ducks, a large proportion of them mallards, and flocks of forty, fifty, or a hundred were seen daily on gravel bars in the Kispiox River. Here the ducks were feeding on salmon roe. Mallard and green-winged teal were the only species present in numbers, and individuals of each of these shot from time to time invariably contained salmon eggs in their gullets. The humpback salmon (*Oncorhynchus gorbuscha*), the species 'running' at that time, was present in myriads, and the ducks formed but a fraction of the animals that were preying upon fish or eggs.

Two adult males partly in the eclipse plumage were shot on September 10, and one (no. 41988) was preserved. In this bird the chestnut breast and gray underparts of the winter plumage are mostly acquired, while of the eclipse plumage there remain the brown-streaked head and neck, many brown feathers on back and flanks, and the tail feathers. An adult male (no. 42638) taken at Okanagan Landing, British Columbia, on October 1, is not nearly so far advanced in the molt, having but a few scattered new feathers over various parts of the head and body.

***Mareca americana* (Gmelin). Baldpate**

One was shot on the Bulkley River at Hazelton, September 17.

***Nettion carolinense* (Gmelin). Green-winged Teal**

Common in Kispiox Valley in September. First seen August 26, a single bird. On August 30 a pair was noted, and a few days later flocks of from forty to fifty birds were frequently encountered. At the end of our stay, September 17, they were still abundant. Two specimens preserved, a female (no. 41989) and a young male (no. 41990).

***Dafla acuta* (Linnaeus). Pintail**

A flock of four seen near the Kispiox River, September 1, and others noted from time to time during the ensuing two weeks. Not abundant.

***Anser albifrons* (Scopoli), subsp.? White-fronted Goose**

A flock of seven white-fronted geese passed overhead, going south, near Hazelton, September 19.

***Branta canadensis* (Linnaeus), subsp.? Canada Goose**

A flock of eight geese was seen in Kispiox Valley, the evening of June 24, flying low and apparently headed for a lake in the woods a few miles from our camp. Their occurrence in a flock at that season seems rather extraordinary. They were geese of the *canadensis* group, and apparently of large size. The subspecific status, of course, could not be ascertained.

***Botaurus lentiginosus* (Montagu). Bittern**

A bittern was flushed from a marsh in Kispiox Valley on August 22, at close enough range to make identification certain, though the bird was not shot. On September 3, late in the evening, a heron of some sort, apparently a bittern, flew over our camp. This, I believe, is as far to the northwest as the species has been seen.

***Ardea herodias* Linnaeus, subsp.? Great Blue Heron**

One seen near Hazelton, June 10, and two in Kispiox Valley on June 20. We were told that herons sometimes occurred in fair abundance along the Kispiox River. Probably it is *Ardea herodias fannini* that occurs in this region.

**Gallinago delicata** (Ord). Wilson Snipe

A fairly common fall migrant in Kispiox Valley. First seen August 20, and subsequently on many occasions up to the time of our departure, September 17. Two specimens preserved (nos. 41991, 41992).

**Pisobia bairdi** (Coues). Baird Sandpiper

A flock of eight seen on the summit of Nine-mile Mountain, August 5, and again (apparently the same flock) on August 10. One shot but not preserved. A flock of six was about a mud puddle in the town of Hazelton, August 15.

**Pisobia minutilla** (Vieillot). Least Sandpiper

Two shot, one (no. 41993) preserved, on the Kispiox River, August 27. An occasional small flock of sandpipers was seen there, but not many.

**Ereunetes mauri** Cabanis. Western Sandpiper

One bird (no. 41994) shot from a small flock on the Kispiox River, August 27.

**Tringa solitaria cinnamomea** (Brewster). Western Solitary Sandpiper

One bird shot, but not preserved, in Kispiox Valley, August 18; the only one seen all summer.

**Bartramia longicauda** (Bechstein). Upland Plover

Appeared in small numbers, migrating, in Kispiox Valley the latter part of August. First seen August 17 (we were told they had appeared some days earlier) and at intervals, two or three birds at a time, until August 26. They frequented open fields where hay was raised, relatively limited areas that had been cleared in recent years. The country in general is densely forested; with settlement, more and more of such clearings have been made, and the species may be extending its range with the opening of favorable areas. This station is, I believe, an extreme western point of record for the upland plover in northern British Columbia. Four specimens were preserved (nos. 41996-41997), apparently all immature birds in first winter plumage.

***Actitis macularia* (Linnaeus). Spotted Sandpiper**

A few individuals seen at intervals through the summer, on the shores of the Skeena and Bulkley rivers near Hazelton, and on the Kispiox River. One specimen (no. 41995) preserved, an immature male taken on the Kispiox River, August 18.

***Dendragapus obscurus flemingi* Taverner. Fleming Grouse**

Found in small numbers on the upper slopes of Nine-mile Mountain, mostly just below the upper limit of upright timber, at from 4500 to 5000 feet altitude. During the three weeks we spent at that place we saw one adult male and eight or ten females. Small young were encountered several times, never more than three or four to a brood, and sometimes only one. Several females seen were alone, and apparently without broods. Three females collected (nos. 42000-42002). Two, taken August 5 and 8, respectively, are just beginning the annual molt. These birds are indistinguishable from specimens taken on the Stikine River, two hundred miles to the northwest (see Swarth, 1922, p. 203).

***Canachites franklini* (Douglas). Franklin Grouse**

Seen in woods of spruce, fir, and hemlock, near the summit of Nine-mile Mountain (4000 to 4500 feet altitude), and along the telegraph line at a point some forty miles north of Hazelton. Eleven specimens collected (nos. 42003-42013): an adult male, two adult females, and three chicks from Nine-mile Mountain; an adult female, two immature males, and two females probably immature, from the second record station. These specimens bear out Riley's (1912, p. 55) comments upon the earlier molt of the adult male, as compared with female and young. The adult male collected August 2 has nearly completed the annual molt. Adult females taken August 10 and 11 are still in the old plumage. The three chicks, taken with the female parent on August 10, an entire family, are about one-quarter grown, in juvenal plumage save for remnants of natal down on the throats of two. Two young males and two apparently young females taken September 12 have nearly completed the molt into first winter plumage; an adult female taken September 12 is nearly through the annual molt.

The one adult male has a nearly uniformly black tail. There is a slight whitish tip to the central feathers, and a faintly indicated light-

colored bar across the center of the tail, not to be seen unless the feathers are widely spread. Of the two immature males, one has the tail black except for scattered and faint reddish spots near the tips of some feathers; the other has the central rectrices narrowly tipped with whitish, some of the others very faintly with pale reddish. Of the five females, all have the central rectrices with more or less of a pale margin at the tip, and only one lacks such tipping to the lateral rectrices.

The adult male has large and conspicuous whitish spots on the long upper tail coverts. On the two immature males these spots are poorly indicated. On the two summer females they are inconspicuous; two of the three fall females have them conspicuously present, in one they are slight. In this series of birds there is no evidence of two color phases (as described by Riley, *loc. cit.*).

***Bonasa umbellus umbelloides* (Douglas). Gray Ruffed Grouse**

Abundant throughout the poplar woods of the lowlands. On June 18 several broods of small young were seen, and from then on flocks of growing youngsters were frequently encountered. Toward the end of August some flocks were of such size as to make it seem probable that they were composed of two or more broods. The cocks are solitary through the summer; even in September extremely wary single birds were flushed that were assumed to be old males that had not yet joined the flocks.

Fourteen specimens collected (nos. 42014-42027), one old male, June 5, the others all taken in September and in the latter stages of the autumnal molt. The molt is completed about October 1. Two are red tailed, twelve gray tailed, indicating a preponderance of the gray phase in this region.

Two fall specimens at hand from St. John trail, upper Peace River, Alberta, may be assumed to be representative of typical *umbelloides*. The birds from Hazelton and Kispiox Valley, though referable to *umbelloides*, are appreciably less grayish, more brownish in coloration, than these Peace River specimens, and they are also less gray than ruffed grouse from the upper Stikine River, to the northward. The increased brownness of the Skeena Valley grouse may be indicative of intergradation toward *sabini* of the southern coastal region of British Columbia. How far north *sabini* extends is as yet undetermined.

**Lagopus lagopus alexandrae** Grinnell. Alexander Willow Ptarmigan

Ptarmigan are said to occur occasionally in the lowlands of the Hazelton region in midwinter, but during most of the year they are restricted to the Alpine-Arctic mountain tops. We found them in limited numbers on the timberless summit of Nine-mile Mountain. There are miles of open country on the two converging ridges that form the top of this mountain, barren of trees save for occasional thickets of dwarfed or prostrate Alpine conifers, and here, at long intervals, we encountered ptarmigan. It is a curious fact, whether or no it was a mere coincidence, that on one of the two ridges only white-tailed ptarmigan were found, on the other, willow and rock ptarmigan were seen, but no white-tailed. To all seeming the two ridges were of exactly the same character. In all, ten broods of willow and rock ptarmigan were encountered (the species were not always to be differentiated) and about five or six single birds in addition. The broods ranged from three to twelve in number; the aggregate of young birds seen was about fifty. The chicks grew rapidly. Some seen on July 25, and a day or two later, were down-covered and unable to fly. At that time they were accompanied by the female parent only, and the male birds were flushed separately. By August 10 the young ptarmigan were the size of quail and larger, and were strong on the wing. The old males were then associated with the families. In some of the larger broods seen the difference in size among the young was so marked as to suggest the junction of two families. It might happen that upon the death of a hen her offspring would seek the companionship of another family.

Five willow ptarmigan were collected (nos. 42028-42032), four adult males and one adult female. Three males have much white on the lower breast and abdomen, the fourth is almost solidly in the brown summer plumage. Many willow ptarmigan from different localities in the northwest have been available for comparison with these birds. Of *Lagopus lagopus lagopus* there is in this Museum from northern Alaska and Yukon (Kowak and Yukon rivers) a series of ninety-four skins, including a number in summer plumage or in process of change. Of *L. l. alexandrae*, there are eleven specimens from island localities in southeastern Alaska, including five summer males, and one male and two females in first fall plumage. A pair of breeding adults from Porcher Island, British Columbia, was loaned by Allan Brooks. There have been available, from the collection of the



Provincial Museum, Victoria, British Columbia, twenty-seven specimens from Lake Atlin, including nine summer males and eight summer females, and a male and female from Anaham Lake.

Island specimens of *alexandrae* (summer males), compared with *lagopus* from the Yukon and Kowak regions, are darker colored and with smaller and differently shaped bill. (The bill difference has been figured by Clark, 1910, p. 53.) Color is darkest in specimens from Prince of Wales Island. Atlin birds and Nine-mile Mountain birds are essentially alike, and are intermediate in color between *lagopus* of the interior and *alexandrae* from the islands; the average is nearer to *alexandrae*. The bill in size and shape is just as in *alexandrae*. Females from Atlin and Nine-mile Mountain differ from Kowak and Yukon birds in bill characters as do the males, and also in color. They are not of darker and richer browns, as might be expected, but present a duller, grayer appearance. In the northern *lagopus* the feathers above and below are broadly edged with bright hazel; in the southern birds these edgings are narrow and dull. On the basis of these comparisons I feel justified in extending the range of *alexandrae* eastward from the coast, at the north to Lake Atlin, at the south to Nine-mile Mountain and Anaham Lake. There is no question as to the difference of these southern mainland birds from *lagopus* of northern Alaska and the interior.

It is of interest to note in *alexandrae* the frequent presence of black shafts on the primaries, sometimes on secondaries and greater coverts. This character has been considered an important feature of the Newfoundland subspecies (*L. l. allen*), as in the "key to the American subspecies of *Lagopus lagopus*" published by Clark (*loc. cit.*, p. 54), but obviously it cannot be used as a feature characteristic of that race alone. In an immature female from Prince of Wales Island (no. 31343, August 27), which has acquired the winter flight feathers, not only are primaries and secondaries with distinct black shafts, but there are large, tear-shaped spots of black near the tips of all the primaries and most of the secondaries. Furthermore, the primaries have a black 'freckling' over much of their surface, and the greater coverts are also marked with black though to a lesser degree.

**Lagopus rupestris** (Gmelin), subsp.† Rock Ptarmigan

Three specimens collected on Nine-mile Mountain, two young birds (nos. 42033-42034) partly in natal down, partly in juvenal plumage, taken August 1, and an adult female (no. 42035) collected August 5.

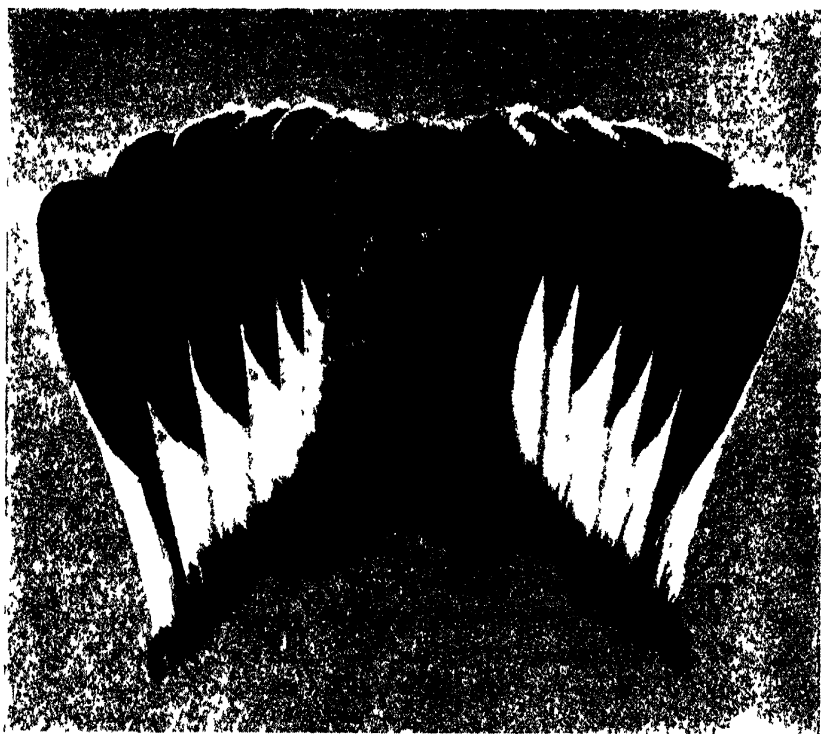


Fig. A. Tail of female rock ptarmigan (no. 42035), natural size. The outermost feather on each side is widely spread from the others to show pattern of coloration on inner web. Drawn by Allan Brooks.

There are not available enough summer specimens from other points to enable me to determine the subspecific status of these birds. There is at hand one summer-plumaged female from the Jade Mountains, north of the Kowak River, collected May 28, 1899 (no. 32170), presumably representative of *Lagopus rupestris rupestris*. Compared with the Nine-mile Mountain female, the Jade Mountains specimen is much brighter colored. There is a great deal of bright hazel in the plumage. The Nine-mile Mountain bird has a smaller bill (as compared also with many winter females from the Kowak River region), and is darker colored. Areas on individual feathers that in the

northern bird are rather brilliantly ruddy are of more restricted size and of a dull tone, and there is extension of black and grayish areas. It seems likely that these two birds represent two different subspecies.

There are no adult females of *Lagopus rupestris dixonii* available, and but two summer males (nos. 371. 372, Port Frederick, Chichagof Island, July 30, 1907). Two summer males from Atlin, British Columbia, loaned by the Provincial Museum, Victoria (no. 2566, June 26, 1914; no. 2589, July 1, 1914), are quite unlike *dixonii*, sufficiently so to make it seem improbable that *dixonii* is a southern race of general occurrence on the mainland as well as on the Alaskan islands.

The Nine-mile Mountain female possesses one feature worthy of comment. The six outer tail feathers on each side are white basally, the total white area covering more than half the tail. On the inner rectrices the white extends over about the basal three-fourths; it decreases on the inner web of the outer feathers, though extending far toward the tip on the outer web (see fig. A). This is exactly the character ascribed to *Lagopus hyperboreas* Sundevall, of Spitzbergen (see Dresser, 1871, p. 179, col. pl. no. 482, text fig.; Ogilvie-Grant, 1893, p. 51). The white tail was not peculiar to the one specimen collected, for other females were seen on Nine-mile Mountain which had the same marking. It was conspicuous in flight. No male was noted with this character; in fact no male *rupestris* was positively recognized.

The two chicks collected are readily distinguished from young *leucurus* by their generally browner color. Young *leucurus* is distinctly gray. The young of *lagopus* is more ruddy throughout.

#### ***Lagopus leucurus leucurus* (Swainson). White-tailed Ptarmigan**

Found only on the eastern ridge of Nine-mile Mountain. Four specimens collected, two adult females and two chicks (nos. 42036-42039). The young birds, taken on July 26 and August 1, respectively, have some natal down about the head; otherwise they are in juvenal plumage. Three broods of white-tailed ptarmigan were seen, one of two chicks, one of three, and one of twelve.

#### ***Circus hudsonius* (Linnaeus). Marsh Hawk**

An adult male was seen repeatedly during parts of June and July about the same locality in Kispiox Valley. At the end of the summer the first migrant was seen September 10, and a few others were noted at later dates.

**Accipiter velox** (Wilson). Sharp-shinned Hawk

Several seen near Hazelton, migrating, May 27. As single birds were encountered at intervals during the summer in Kispiox Valley and on Nine-mile Mountain, it seems likely that a few pairs breed in the region. The last week in August, with the beginning of the migration, sharp-shinned hawks became fairly abundant. That is, one or two birds were seen daily, some days four or five might be encountered. Three specimens collected: an adult male, May 31 (no. 42040), an adult female, just beginning the annual molt, July 13 (no. 42042), and an immature male, August 19 (no. 42041).

**Astur atricapillus atricapillus** (Wilson). Eastern Goshawk

During the third week in August migrating goshawks appeared, and from then on, during September, they were abundant. Scarcely a day passed without at least one being seen, and frequently seven or eight would be noted within a few hours. The species is usually solitary but it was not uncommon here to find two together. Mostly they were young birds, and as a rule absurdly unsuspicious. Two of the three goshawks collected during August (nos. 42045, 42046), all in immature plumage, are evidently of the subspecies *atricapillus*, and I believe that nearly all seen at that time were the same. They appeared to constitute a migratory 'wave' from some more northern region.

**Astur atricapillus striatulus** Ridgway. Western Goshawk

A female goshawk (no. 42043) of this subspecies collected at Hazelton, on May 30 is, save for a few scattered feathers on the tibiae, in immature plumage throughout. A male bird (no. 42044) taken July 16 is in the midst of the molt from the immature to adult plumage. An immature male (no. 42046) was collected in Kispiox Valley, August 29. The last mentioned appeared at the same time as other migrating hawks. The other two, taken in May and July, respectively, may indicate the breeding of this subspecies in the region. They could not be positively recognized as breeding individuals, however. Remains of flicker and ruffed grouse were found in the stomach of no. 42044; ruffed grouse in that of no. 42046.

***Buteo borealis calurus* Cassin. Western Red-tailed Hawk**

Several pairs were breeding near Hazelton and in Kispiox Valley. In the latter locality, not far from our camp, there was an occupied nest at the top of a tall tree that towered above a surrounding jungle, too impenetrable to be traversed.

Toward the end of August there was a noticeable increase in the number of red-tails observed, due probably to an influx of migrants, and many were seen up to the end of my stay, September 26. There was wide variation in color; light-breasted birds were seen and some exceedingly dark ones. One specimen was collected (no. 42048), an immature male, taken in Kispiox Valley August 27. It is in the dark phase of plumage, blackish throughout with extensive white streaks and blotches partly concealed at the bases of the feathers.

***Buteo swainsoni* Bonaparte. Swainson Hawk**

Hawks supposed to be of this species were seen occasionally late in August and early in September, but only one was shot. This bird (no. 42049) is an immature male, taken in Kispiox Valley, August 24. Its stomach contained a toad.

***Aquila chrysaëtos* (Linnaeus). Golden Eagle**

Seen at intervals during the summer. at Hazelton, at the base of the nearby mountain range, Rocher Déboulé, and on Nine-mile Mountain. From July 16 to 20 one was seen daily at Hazelton, haunting the river banks and evidently feeding on dead salmon. On Nine-mile Mountain one followed a regular beat almost daily, recognizable as the same individual through a peculiarity of marking. This bird was hunting marmots assiduously and swung about the mountain side low over the ridges, apparently trusting his sudden appearance to enable him to surprise a marmot at a distance from shelter.

***Haliaeetus leucocephalus alascanus* C. H. Townsend.****Northern Bald Eagle**

Seen in the lowlands at various times during the summer. As the season advanced, the dead and dying salmon on the river banks were a bountiful source of food to the eagles, and increasing numbers of the birds appeared. What seemed to be entire families were seen several times, in July, groups composed of two adults with two or three full-grown young.

**Falco columbarius columbarius** Linnaeus. Eastern Pigeon Hawk

**Falco columbarius suckleyi** Ridgway. Black Pigeon Hawk

The two subspecies of the pigeon hawk that are found in the region are rarely to be distinguished in life, so that birds seen can be recorded only under the specific name. Two pigeon hawks observed near Hazelton on May 26 were presumably migrants; none was noted during midsummer. The first fall migrant appeared August 22, and from then on to the end of my stay (September 26) some were seen nearly every day, sometimes several in one day.

The pigeon hawk is a remarkably swift flier, a fact borne out by the stomach contents of one of my birds, the remains of a black swift (*Cypseloides niger borealis*). That this hawk can capture a swift in fair chase in the open is not likely (see Meinertzhagen, 1921, p. 237), but after observation of both species I see no reason to doubt that on occasion the swift could be taken unawares and caught by the hawk after a short burst of great speed. This is in opposition to a possible explanation that in the case in question the hawk had captured a sick or disabled bird.

Six specimens collected: one adult male, three immature males, and two (presumably) immature females. This series is of interest in its bearing upon the relationship of *columbarius* and *suckleyi*. Not one of the lot is typical of *columbarius*, though I have so labeled five of them (nos. 42050-42053, 42055), as most closely resembling that subspecies. One female (no. 42054, Kispiox Valley, August 29) is a typical, even an extreme, example of *suckleyi*. The second female (no. 42053, Kispiox Valley, September 12) is nearer true *columbarius* than any others of this series. The three immature males (nos. 42050-42052), taken in Kispiox Valley on August 28, 22, and 23, respectively, are intermediate in appearance between *columbarius* and *suckleyi*, an intermediateness that is exhibited in a rather curious way. Ventrally they are in color and markings practically like *columbarius*, but dorsally they are quite as dark colored as the average immature *suckleyi*. This same sort of intermediateness, that is, light ventral and dark dorsal coloration, is also shown in an immature female (no. 39762) from the lower Stikine River, British Columbia, collected August 14, 1919 (see Swarth, 1922, p. 214), and intermediateness both above and below is shown in an immature female (no. 40371) taken near Coulterville, California, on December 20, 1919.

The adult male collected (no. 42055, Hazelton, September 24) is referred to *columbarius*, though darker colored than any other adult of that subspecies that I have seen. There are nine adult male pigeon hawks in the several collections housed in the Museum of Vertebrate Zoology, and these exhibit an interesting range of variation. An extreme of darkness is represented by the Hazelton bird above referred to, but slightly removed from that of *suckleyi*. At the opposite extreme, of light coloration, is an example of *richardsoni*. Between, there are seven specimens, labeled *columbarius*, illustrating unbroken gradation from one extreme to the other. Thus, in adult birds as in immatures, there is no one character of color or markings that may be taken as absolutely indicative of any one form. The three names, *columbarius*, *suckleyi*, and *richardsoni*, apply to three subspecies of one species, between which no definite lines may be drawn.

There is this to be said, however, that the above comments are based, not upon breeding birds, but upon specimens collected during the migrations and in winter. The line of nicely graded adults just described was not arranged with regard to geographic continuity. Breeding pigeon hawks are scarce in collections (not one was available to the present writer) and, for the most part, deductions must be drawn as best they may from non-breeding birds.

The Hazelton series is of interest in that it includes a specimen of *suckleyi* from what I believe is the northernmost point at which this subspecies has been definitely recorded. This place is at an intermediate point between humid coast and arid interior, and most of the pigeon hawks taken there are intermediate in appearance. Of course these birds were not found actually breeding, but the conclusion does not seem forced that they are representative of the form that does breed in that general region.

In this discussion I have ignored the recently described *Falco columbarius bendirei* of Swann (1922, p. 66; type locality, Fort Walla Walla, Washington). It may be possible eventually to demonstrate the existence of this additional western subspecies, but the two eastern specimens available to me are not to be distinguished from western birds here regarded as *columbarius*.

#### **Falco sparverius sparverius** Linnaeus. American Sparrow Hawk

A fairly common summer visitant to the lowlands. A few were seen in the open country above timber on Nine-mile Mountain, but that was early in August and the birds noted had probably wandered

from nesting grounds at lower altitudes. Abundant in Kispiox Valley and about Hazelton during the latter part of August, and in lessening numbers in September. Some were seen up to the time of my departure, September 26.

Fifteen specimens collected (nos. 42056-42070). Full-grown young were taken July 18. An adult female taken August 20 has finished the annual molt; an adult male taken on the same date, and another shot September 7, are still in the midst of the change.

***Pandion haliaëtus carolinensis* (Gmelin).** Osprey

We found no ospreys breeding in the region covered, but about the middle of August, with the coming of the salmon, the fish hawks began to appear. During the latter part of August and throughout September, some were seen almost daily.

***Bubo virginianus lagophonus* (Oberholser).** Ruddy Horned Owl

Exceedingly abundant throughout the lowlands. At our timberline camp on Nine-mile Mountain we neither saw nor heard horned owls, but they were present everywhere in the valleys, and in unusual numbers for a large, predatory bird. The abundance of rabbits in the region may have caused a temporary increase in the number of horned owls.

Twenty-one specimens were collected (nos. 42071-42091). Of these, six are young, mostly down-covered (two in one brood, June 5; four in one brood, June 24); the rest are young and old in fresh fall plumage. Food was found in eight stomachs. In one case a young owl had been fed a red squirrel, the others contained rabbit and nothing else. This is noteworthy in view of the general belief that the horned owl is an inveterate enemy of grouse. These owls inhabited the poplar woods, precisely the same environment as the ruffed grouse, and ruffed grouse were abundant.

Considerable color variation is shown in this series of owls, gray colored birds at one extreme, brown colored at the other. The grayest bird (no. 42091) was the last one shot, on September 9, and might be assumed to be a migrant of a race other than the breeding form, but there are earlier taken specimens in the series that are nearly as light colored. I think it safe to say that the differences illustrate the extent of individual variation existent in the subspecies *lagophonus* in this one region. (For use of the name *lagophonus*, see Oberholser, 1904, p. 185; Ridgway, 1914, p. 747.)



**Ceryle alcyon caurina** Grinnell. Western Belted Kingfisher

By streams and lakes everywhere in the lowlands. Present in the region when we arrived, May 25, and up to the time of our departure, September 26. One specimen collected (no. 42092).

**Dryobates villosus monticola** Anthony.

## Rocky Mountain Hairy Woodpecker

Fairly common in the lowlands, mostly in deciduous timber. Present during the whole of our stay; probably resident the year through. Young were seen flying about on June 22; birds taken September 1 had finished the molt. Twelve specimens collected (nos. 42093-42104), seven breeding adults, two in juvenal plumage, and three in fresh fall plumage.

**Dryobates pubescens leucurus** (Hartlaub). Batchelder Woodpecker

In small numbers in deciduous woods in the lowlands. Young out of the nest were taken June 29. Two specimens collected September 5 and 8, respectively, had finished the molt. Thirteen specimens in all were collected (nos. 42104-42117).

A specimen of downy woodpecker from Fort Babine, in this same general region, has been ascribed by Ridgway (1914, p. 239) to the subspecies *Dryobates pubescens glacialis* Grinnell (type locality, Prince William Sound, Alaska). This induced comparison of the Skeena Valley series with the four Alaskan specimens of *glacialis* at hand, and the two lots were found to be indistinguishable. In the original description of *glacialis* (Grinnell, 1910, p. 390), comparisons are made with *nelsoni*, of the interior of Alaska, and *gairdneri*, of the coast of British Columbia. The American Ornithologists' Union Committee (1912, p. 386) refused recognition to the race *glacialis* on the grounds that it was an "intergrade between *D. p. nelsoni* and *gairdneri*." Ridgway (1914, p. 239) accords recognition to *glacialis*, but, in describing the race, compares it again with the Alaskan *nelsoni*, and also with the eastern *medianus*.

So far, no comparisons had been made between *glacialis* and the downy woodpecker of the more southern Rocky Mountains, *D. p. homorus* of recent literature. The Skeena Valley series, however, was taken sufficiently near the known range of that subspecies to suggest the desirability of such comparisons. Pertinent material is at hand

as follows: Prince William Sound, Alaska, 2 specimens (including the type of *Dryobates pubescens glacialis*); lower Taku River, Alaska, 2; Skeena River region (Hazelton and Kispiox Valley), British Columbia, 13; Warner Mountains, California, 4; Sierra Ancha, Arizona, 2. In my opinion, the downy woodpeckers from these several points should all be included under one name. As shown in the accompanying table, the southern birds are slightly larger than the northern ones, which is curious, considering north and south variation in general in the genus *Dryobates*. The southern birds are also somewhat blacker, that is, with less white spotting upon wings and coverts. Individual variation is such, however, that it is impossible satisfactorily to diagnose two subspecies in the material examined.

For the application of the name *Dryobates pubescens leucurus* (Hartlaub) to the downy woodpecker of the Rocky Mountain region, see Grinnell 1923, p. 30.

TABLE 1  
MEASUREMENTS IN MILLIMETERS OF *Dryobates pubescens leucurus*

Mus. No.	Sex	Locality	Date	Wing	Tail	Culmen
1287	♂	Prince William Sound, Alaska,	Sept. 7, 1908	93	57	15.5
9732	♂ im.	Taku River, Alaska,	Sept. 4, 1909	92.5	56.5	15.8
9733	♂	Taku River, Alaska,	Sept. 13, 1909	97.5	58	15.2
42117	♂	Kispiox Valley, B. C.,	July 13, 1921	96.5	59	16.5
42115	♂	Kispiox Valley, B. C.,	Sept. 5, 1921	97	61	15
14137	♂	Warner Mts., Calif.,	June 29, 1910	98	58†	18.5
14138	♂	Warner Mts., Calif.,	June 30, 1910	101	65	18
27710	♂	Sierra Ancha, Arizona,	June 23, 1917	99.5	65.5	18
1288*	♀	Prince William Sound, Alaska,	Sept. 18, 1908	97.5	61	15
42105	♀	Hazelton, B. C.,	June 16, 1921	94	60	16
42108	♀	Kispiox Valley, B. C.,	June 29, 1921	95.5	62.5	16
42111	♀ im.	Kispiox Valley, B. C.,	July 9, 1921	95.5	61.5	16.5
42116	♀	Kispiox Valley, B. C.,	Sept. 8, 1921	97.5	.....	15.5
14139	♀	Warner Mts., Calif.,	June 30, 1910	97.5	63.5	17.5
14140	♀	Warner Mts., Calif.,	July 6, 1910	100	62	17
27711	♀	Sierra Ancha, Ariz.,	June 25, 1917	100	67	17

\* Type of *Dryobates pubescens glacialis* Grinnell.

† Rectrices shortened by wear.

### **Picoides arcticus** (Swainson). Arctic Three-toed Woodpecker

Not common. We had been in the region three weeks before seeing a three-toed woodpecker of either kind. *Picoides arcticus* and *P. a. fasciatus* were then both discovered, each in small numbers, and under precisely the same conditions. They were in the lowlands, but inhabit-

ing the little muskegs that are scattered through the woods, well defined areas for which certain bird species showed a marked preference. No three-toed woodpeckers were seen on Nine-mile Mountain, though both species occur as a rule in the Hudsonian zone.

A nest of the Arctic three-toed woodpecker was found in Kispiox Valley. It was placed in a dead and charred Engelmann spruce, in a strip of spruce woods bordering a muskeg otherwise surrounded by poplar forest. The nest hole was eighty feet from the ground. It was two and one-half inches in diameter and one foot deep, drilled through an outer sheath of sound, hard wood, and downward through soft, rotten 'punk.' On July 3 it held one young bird nearly ready to fly, and a second, not much smaller, which had been dead for some days.

Four specimens collected (nos. 42118-42121), the young female mentioned above, its female parent, and, at other times, two adult males.

#### **Picoides americanus fasciatus** Baird. Alaska Three-toed Woodpecker

Four specimens collected (nos. 42122-42125), one adult male and three adult females. They differ from Alaskan examples of *fasciatus* in the notable restriction of white dorsal markings. The white bars on the back are limited in extent and in only one specimen is there even a trace of the white coalescing longitudinally. All four, however, show white spots on rump and upper tail coverts, markings that are supposed to distinguish *fasciatus* from *americanus*.

#### **Sphyrapicus varius ruber** (Gmelin). Red-breasted Sapsucker

All through the valleys this species was far more abundant than I have ever found sapsuckers elsewhere. It is curious that there should be this abundance here; this must be near the outskirts of the range of the bird. *Ruber* is regarded primarily as a coastal species, yet nowhere on the coast is it found in such numbers. On the southeastern Alaskan coast, near the Skeena River, it is doubtful if an observer would in a whole summer see twenty birds—the number counted near Hazelton in one forenoon.

During May and June a number of nests were found, mostly through seeing the old birds carrying food to the young. One was drilled in a live poplar, the tree a straight column with no branching limbs save at the very top, the nest some seventy feet from the ground. Another was in a dead birch, sixty feet up. Many others were noted,

all in birch or poplar, mostly dead trees, and no nest was less than fifty feet above the ground. One male bird collected had the abdomen bare of feathers. It obviously had been incubating eggs.

The first young bird was seen flying about on July 7. Shortly after, the species became notably scarce and few of the birds were observed through July and August. This, perhaps, was from some change in habits rather than a shifting of population. The first week in September numbers appeared once more. Several factors contribute to bring the sapsuckers conspicuously in view. They are assiduous drummers, on dead trees or on telegraph poles; they have querulous and noisy call notes, uttered near the nest; they are active flycatchers, using a telegraph pole or an isolated tree in a clearing as a base from which to fly.

Fourteen specimens collected (nos. 42126-42139). These are exactly like coastal birds in coloration, but differ in average bill structure. Compared with specimens from the nearby coast of southeastern Alaska, the Hazelton birds have the bill noticeably short and heavy. There is some overlapping in the two lots, for some Alaskan specimens have bills as short as some Hazelton birds. None of the latter series, however, has the long, slender bill that is generally characteristic of the Alaskan birds. Adult sapsuckers from the upper Stikine River (see Swarth, 1922, p. 220) have the same type of bill as the Hazelton birds. (For use of the name *ruber* for the northern subspecies of the red-breasted sapsucker see Swarth, 1912, p. 34.)

### ***Phloeotomus pileatus picinus* Bangs. Western Pileated Woodpecker**

In June and again in late September, single birds were seen or heard several times near the base of Rocher Déboulé, southeast from Hazelton. This must be about the extreme northern limit of the species in this region. None was seen in Kispiox Valley, a few miles to the northward. One specimen collected (no. 42140), a male taken September 22.

### ***Colaptes auratus borealis* Ridgway. Boreal Flicker**

Breeds abundantly in the lowlands, mostly in deciduous timber. Present when we arrived, May 25, and until our departure, September 26. During the last two weeks in August flickers were extremely scarce; then, early in September, they suddenly appeared in numbers and remained abundant throughout the month.

Hazelton is near the western limit to which the yellow-shafted flicker might be expected to range; it cannot be far to the westward that the red-shafted flicker (*Colaptes cafer cafer*) occurs. It is of interest that, of the breeding specimens from Hazelton and Kispiox Valley, nearly all show traces of *cafer* blood. The four adult summer males collected all show more or less red in the normally black 'mustache.' In females the *cafer* characters are not so conspicuous, showing sometimes in a tinge of reddish in the quills, sometimes in certain details of body markings or color. In one case, wings and tail are nearly as red as in typical *cafer*. Some young males (nestlings) show red in the 'mustaches,' but not so conspicuously as do the adults.

The flickers that arrived so numerous in September were, I believe, migrants from the north, from a region far removed from any chance of admixture with *cafer*. Five collected at that time are all typically *auratus*-like in every detail. In all, twenty-eight yellow-shafted flickers were collected (nos. 42141-42168). The series includes twelve nestlings, eight in one lot (the entire brood), and four from another brood that consisted of six in all.

***Chordeiles virginianus virginianus* (Gmelin). Eastern Nighthawk**

Arrived at Hazelton, June 3. Fairly common in the lowlands thereafter until about the middle of August, when the birds began to disappear. Last seen August 31. Two specimens collected (nos. 42169-42170), adult male and female.

***Cypseloides niger borealis* (Kennerly). Black Swift**

Abundant throughout the summer. Usually seen flying high overhead, seldom within gunshot of the ground. One specimen collected (no. 42171), an adult female, at Kispiox Valley, August 20.

***Chaetura vauxi* (J. K. Townsend). Vaux Swift**

A few birds (perhaps three pairs) seen occasionally at a certain spot in the woods near Hazelton. Small flocks or single individuals noted at long intervals in Kispiox Valley. Last seen September 3. One specimen collected (no. 42172), an adult male, July 20.

***Selasphorus rufus* (Gmelin). Rufous Hummingbird**

Abundant about Hazelton when we arrived, May 25. Frequenting gardens in the town and generally distributed through the lowlands. On Nine-mile Mountain a few hummingbirds were seen, perhaps ten or twelve all told during our stay (July 21–August 14); apparently all were young birds, wanderers from the valleys below. By the time we descended from the mountain, there were very few rufous hummingbirds left in the lowlands. No more old males were seen, and the last female or young was noted on August 18. Two specimens were collected, an adult male at Hazelton, May 30 (no. 42173), and an immature male on Nine-mile Mountain, August 4 (no. 42174).

***Tyrannus tyrannus* (Linnaeus). Eastern Kingbird**

Two seen during the summer, an adult male taken near our Kispiox Valley camp on June 22 (no. 42175), and an adult female at Hazelton, July 20 (no. 42176). The first mentioned appeared to be in breeding condition. The Hazelton bird was first seen flying, approaching from a distance with all the appearance of a migrant. These captures constitute, I believe, an extreme northwestern point of record for this species.

***Sayornis sayus yukonensis* Bishop. Northern Say Phoebe**

Apparently not breeding in this general region; at least, none was seen until the end of the summer. First noted, a single bird, August 23, obviously a migrant. Another on August 24 and two on August 26 make up the total number recorded. These four specimens (nos. 42177–42180), two males and two females, are all in juvenal plumage. Besides these birds there are two other northern examples of this species in the collection of this Museum, an adult male from Forty-mile, Yukon Territory (no. 4594) and a juvenal female from Sergief Island, Alaska (no. 39815). The adult has been described by Grinnell (1909, p. 206) as showing the characters ascribed to the subspecies *Sayornis sayus yukonensis* Bishop (1900, p. 115). The Sergief Island specimen has been recorded (Swarth, 1922, p. 224) as *Sayornis sayus*, with comment upon its appearance; it is exactly like the Kispiox Valley specimens. Altogether, this series, one adult and five juvenals, bears out Bishop's (*loc. cit.*) contention of the existence of a recognizable northern form of *Sayornis sayus*. In the young birds from the north,

the darker color and the lack of rusty markings dorsally and on the wings, as compared with southern specimens, is constant and conspicuous. The northern adult differs in measurements and proportions from any southern skin.

**Nuttallornis borealis** (Swainson). Olive-sided Flycatcher

Not common, but occurring as scattered pairs throughout the lowlands. Present when we arrived, the last week in May. Last bird seen September 2. One specimen collected (no. 42181).

**Myiochanes richardsoni richardsoni** (Swainson).

Western Wood Pewee

Common in the lowlands, usually about clearings. On our first day in the field, May 27, wood pewees were fairly numerous. The last was seen September 4. Six specimens collected, all breeding adults (nos. 42182-42187).

**Empidonax trailli alnorum** Brewster. Alder Flycatcher

An inhabitant of willow thickets in lowland swamps. Not common, and so shy that the species could easily be overlooked were it not for the call note. First arrival noted June 5; last bird seen August 24. Five specimens collected (nos. 42188-42192), three adult males, and two males in first winter plumage.

**Empidonax hammondi** (Xantus). Hammond Flycatcher

Abundant in the poplar woods of the lowlands. Present in numbers when we arrived, the last week in May, and almost up to the time of our departure. Early in September there was a marked diminution in numbers, but a few Hammond flycatchers appeared at intervals up to September 21, when the last one seen was collected. Ten specimens taken (nos. 42193-42202).

A nest (no. 1852) taken near Hazelton, June 16, contained two fresh eggs, probably an incomplete set. It is constructed outwardly of 'cotton' from the fireweed, and some plant fiber, and moss; the lining is of feathers and cattle hair.

A second nest (no. 1853), taken in Kispiox Valley, July 7, contained three slightly incubated eggs, a complete set. It was in a willow thicket at the edge of a small stream, about twenty feet from the

ground, and wedged between several limbs forming an upright crotch. This nest outwardly is composed mostly of finely shredded strips of bark; the lining is of cattle hair, with a few feathers of grouse and other birds. In each set the eggs are white, unmarked.

### ***Empidonax wrighti* Baird. Wright Flycatcher**

In the lowlands, in just such surroundings as are frequented by *Empidonax hammondi*. The two species are so nearly alike in life as to be indistinguishable to the eye, but different call notes serve for identification. On this basis it may be said that *E. wrighti* was rare, compared to the abundant *hammondi*. Three specimens, all adult, were collected (nos. 42203-42205); male, June 27; female, August 17; female, August 25. The two August birds are still mostly in worn breeding plumage.

One nest was found in Kispiox Valley. It was in a small, isolated clump of willows, in an upright crotch formed by several dead limbs, and about ten feet from the ground. On July 4 it contained two eggs, just hatching.

### ***Otocoris alpestris arcticola* Oberholser. Pallid Horned Lark**

In small numbers on the Alpine-Arctic summit of Nine-mile Mountain. The last week in July young birds were seen flying about. Three adults collected (nos. 42206-42208), a male and a female on July 31, a male on August 1. The males are well advanced in the annual molt, the female has hardly begun.

On September 22 four horned larks were seen flying overhead near Hazelton. This, evidently the beginning of the fall migration, was the only lowland occurrence observed.

### ***Cyanocitta stelleri annectens* (Baird). Black-headed Jay**

A few seen the last week in May and early in June, toward the base of Rocher Déboulé, southeast of Hazelton. They did not act like nesting birds, and three specimens collected were evidently not breeding. In Kispiox Valley one appeared August 27, and thereafter, during September, they drifted through from time to time, usually single birds. On September 11 and 12 many were seen along the trail following the telegraph line some forty miles north of Hazelton. The last week in September they were fairly numerous near Hazelton, where we had seen them before in May. No black-headed jays were found on Nine-mile Mountain, where they might have been expected to breed.



Sixteen specimens collected (nos. 42209-42224), twelve in fresh fall plumage. In this series there is considerable variation in the white spot over the eye, one of the diagnostic features of *annectens*. In nine specimens it is conspicuously present, in five it appears in slight degree, and in two it is absent. This series was collected at what must be practically the northern and western limits of the subspecies *annectens*, and variation such as that described is presumably indicative of intergradation toward the coastal subspecies, *stelleri*. In dorsal coloration this series is decidedly blackish, as compared with the brownish cast seen in comparable examples of *stelleri*; the blue areas are appreciably paler, more greenish. These differences are sufficiently marked to justify the allocation of the entire series to the subspecies *annectens* despite the variation shown in one particular. There is no adequate series of typical *annectens* available to show the extent of divergence from the ordinary body color in that race.

***Perisoreus canadensis canadensis* (Linnaeus). Canada Jay**

Undoubtedly nests in the Hudsonian Zone on the mountains near Hazelton, descending into the lowlands in fall and winter. There were a few Canada jays on the middle slopes of Nine-mile Mountain. A young bird shot there on July 23 had nearly finished the post-juvenal molt; an adult taken August 2 was nearly through the annual molt. A number seen forty miles north of Hazelton, September 12, in Hudsonian Zone surroundings. One noted in Kispiox Valley, August 31, and several toward the base of Rocher Déboulé, southeast of Hazelton, September 22. Four specimens collected (nos. 42225-42228).

***Corvus brachyrhynchos hesperis* Ridgway. Western Crow**

A few crows were seen in the immediate vicinity of Hazelton during the latter part of May and the first two weeks in June. None was seen later in the summer or at any other point. Four specimens collected, two adult males and two adult females (nos. 42229-42232).

***Agelaius phoeniceus arctolegus* Oberholser. Northern Red-wing**

An immature male that was collected in Kispiox Valley, September 7 (no. 42233), was the only red-winged blackbird seen; its capture constitutes an extreme northwestern point of record for the species. This bird has a remarkably heavy bill. In depth of bill at base (14 millimeters) it reaches the maximum of this measurement as given by Oberholser (1907, p. 335) in his description of the subspecies *arctolegus*.

**Euphagus carolinus** (Müller). Rusty Blackbird

Fairly common in the lowlands about Hazelton and in Kispiox Valley, but so quiet and secretive during the nesting season as easily to be overlooked. A female shot June 4 had laid part of its set. On July 5 a flock of old and young together first appeared. An adult female shot August 20 had nearly finished the annual molt; an immature male taken September 9 had finished the post-juvenal molt. The species was present in abundance at the end of my stay, September 26. By the middle of September the birds had gathered into flocks of from twenty to fifty individuals. Thirteen specimens collected (nos. 42234-42246).

**Hesperiphona vespertina brooksi** Grinnell.

British Columbia Evening Grosbeak

Small flocks seen near Hazelton during the last week in May and the first week in June. No evidence of breeding was found. Three specimens collected, two adult males and one adult female (nos. 42247-42249). This, I believe, is the northernmost record for the species in British Columbia. (For characterization of the subspecies *H. v. brooksi*, see Grinnell, 1917, p. 20.)

**Carpodacus purpureus purpureus** (Gmelin). Eastern Purple Finch

Not found above the floor of the valley. Single birds and small flocks seen about Hazelton the latter part of May and in June; a female shot June 4 was incubating eggs. In Kispiox Valley, the latter part of August, purple finches were seen occasionally, the last on August 29. Seven specimens collected, four red males, one male in the streaked plumage, and two females. These are all typically of the subspecies *purpureus*.

**Loxia leucoptera** Gmelin. White-winged Crossbill

Small flocks (eight to twelve birds each) seen at Hazelton, June 14, in Kispiox Valley, July 8, and again near Hazelton the latter part of September. On Nine-mile Mountain (July 21 to August 14), white-winged crossbills were present in small numbers in the hemlock forest immediately below timber line, that is, four or five individuals might be seen during a forenoon. This was evidently the nesting ground, as single males were spaced at intervals through the woods, and were in full song. Four specimens collected, three adult females and one adult male (nos. 42257-42260).

***Leucosticte tephrocotis littoralis* Baird. Hepburn Rosy Finch**

Seen only on Nine-mile Mountain. Not abundant, or at any rate not seen frequently. An occasional small flock or a single bird might whirl overhead now and then, or the elusive call note might be heard faintly in a gust of wind, such as often prevailed about the crags and snow banks where the rosy finches dwelt. but the birds were seldom found feeding quietly. On July 26 three adults and three young (nos. 42261-42266) were collected from a flock of several times that number. The juveniles were as large as their parents, and with wing and tail feathers grown to their full length, but they were still being fed by the old birds.

***Spinus pinus pinus* (Wilson). Pine Siskin**

The most abundant species of bird in the Hazelton region, both in the lowlands and on the mountains, even above timber line. Present when we arrived, May 25, and at our departure, September 26. On July 19 an old bird was seen feeding a full-grown young one. Siskins were in flocks throughout the summer: there must have been many of the birds that were not breeding. Toward the end of summer the flocks increased in size. On Nine-mile Mountain, at the end of July, twenty-five to thirty was an average sized gathering; the middle of August, forty or fifty would be seen together; and by September 1 flocks numbering a hundred or more were of frequent occurrence. Two adults collected (nos. 42267-42268).

***Calcarius lapponicus alascensis* Ridgway. Alaska Longspur**

A fairly common fall migrant. Arrived in Kispiox Valley, September 1, and from then on, during September, small flocks were seen almost daily. Two specimens collected, immature males (nos. 42269-42270).

***Calcarius pictus* (Swainson). Smith Longspur**

An immature male (no. 42271) collected in Kispiox Valley, August 25. This was undoubtedly a migrating straggler to this point. Whether the species breeds east of the Rocky Mountains in northern British Columbia is not known, but it may very well do so. The one previous record for the province is of a single bird taken at the summit of "Boundary Pass" (the extreme southeastern corner of British Columbia), May 15, 1858 (Blakiston, 1862, p. 6; 1863, p. 72).

***Calcarius ornatus* (J. K. Townsend).** Chestnut-collared Longspur

An adult female (no. 42272) in worn summer plumage collected in Kispiox Valley, July 8. I do not believe that this bird was breeding at the point where it was taken; it was most likely a wanderer that had strayed far from the breeding grounds. This is an even more extraordinary occurrence than the capture of the Smith longspur six weeks later at the same place. The latter species is known to breed to the northeast of this region, and a slight deflection to the westward by a south-bound migrant would account for the stray we collected. The chestnut-collared longspur, however, is not known to breed nearly so far north as this in the interior; presumably it required a long flight to the northwest to bring this bird to the place where it was found. I believe that this is the first recorded occurrence of the species in British Columbia.

***Passerculus sandwichensis alaudinus* Bonaparte.**

## Western Savannah Sparrow

There were a few Savannah sparrows migrating through Hazelton during the last week in May. In Kispiox Valley a little later small numbers were breeding in hay fields and pastures. In the open country at the summit of Nine-mile Mountain (5000 to 5500 feet altitude) the species was breeding in fair abundance. In Kispiox Valley again, the third week in August, there was an influx of migrating Savannah sparrows; they came in swarms, reaching the maximum of abundance about the middle of September. Some were seen up to the day I left, September 26.

Nineteen specimens collected (nos. 42273-42290, 42410): at Hazelton, May 30, two, adult male and female; Kispiox Valley, adult female, July 9; juvenal male, July 12; two adult females, four immature females, three immature males, August 24 to September 10; Nine-mile Mountain, July 23 to 29, three adult males, three adult females. The Nine-mile Mountain specimens are *alaudinus*; they are exactly like Savannah sparrows from more northern points in the interior of British Columbia and Alaska. The status of the Savannah sparrow breeding in the lowlands of the region cannot be settled at this time. The one adult collected that was actually breeding (no. 42275, female, Kispiox Valley, July 9), is of small size and with short, stubby bill. The two shot at Hazelton on May 30 were not breeding; they may or

may not have been about to nest nearby. They, too, are of rather small size and with short bill, as compared with typical *alaudinus*. The juvenal from Kispiox Valley, compared with young of *alaudinus* from Kotzebue Sound, is slightly darker colored and with noticeably more stubby bill. Savannah sparrows taken in Kispiox Valley during late August and early September are *alaudinus*, presumably migrants from the northward.

To summarize: The Savannah sparrow breeding on the mountain tops of this region is *Passerculus sandwichensis alaudinus*. The Savannah sparrow breeding in the lowlands appears to be another race. Presumably it would be *Passerculus sandwichensis brooksi* (Bishop, 1915, p. 187), described from the lowlands of southern British Columbia. There is no series of *brooksi* available for comparison. For the present the entire series from the Hazelton region may be left under the name *alaudinus*. None of the lot bears any close resemblance to *Passerculus sandwichensis savanna* of the coast of southeastern Alaska, a short distance to the westward.

### ***Zonotrichia leucophrys gambeli* (Nuttall). Gambel Sparrow**

A fairly common summer visitant, restricted to the lowlands. When we reached Hazelton, May 26, Gambel sparrows were evidently nesting. Singing males were established in many of the gardens in the town; elsewhere scattered pairs were encountered at rather wide intervals in sparse timber. In Kispiox Valley a few were seen early in July; by the middle of the month they had disappeared. This species is remarkably secretive in its nesting. Specimens in the juvenal plumage were desired and special search made for them, but, although adults were seen in fair abundance, not only were no nests discovered but not a single young bird was seen. Then, the second week in July, came the apparent disappearance of the species for a period of several weeks. On August 24 a bird in first winter plumage was shot, the first of a migratory wave, and the next day the bushes were full of Gambel sparrows. These were all immatures, with brown head stripes; the first adult was seen September 1. When I left, September 26, the species was still fairly abundant.

Six specimens collected (nos. 42291-42296), three adult males, one adult female, and two immature males.

**Zonotrichia coronata** (Pallas). Golden-crowned Sparrow

Breeding in fair abundance above timber line on Nine-mile Mountain. When we arrived there (July 22) the young were out of the nest and flying about; the old birds could be seen singing from perches above the thickets in which they dwelt. Specimens in juvenal plumage were among our special desiderata and every effort was made to shoot them, but so wary were these young birds that we deemed ourselves lucky to get even the three we eventually collected. At the first sign of danger a loud *chip* from the parent sends every youngster within hearing scuttling for the nearest tangle of prostrate balsam, but not to remain there. A prompt retreat is made to the far side of the bush, followed quickly by flight to another thicket perhaps a hundred yards away. Pursuit is heralded by warning alarm notes from the parent, and the youngster again flees to another refuge. Further pursuit is generally useless. In fact, young birds were seen to go five hundred yards or more in one flight when followed up. Meanwhile, the old bird, perhaps joined by others, remains nearby, giving warning from some conspicuous perch, utterly indifferent to approach within a few yards. The warning *chip* of the adult golden-crowned sparrow was a familiar note in the balsam thickets along the ridges. It accompanied us nearly everywhere in our travels on the summit.

The extreme wariness of the young golden-crowned sparrow is a trait that receives emphasis from the fact that, when the first winter plumage is attained a few weeks later, these same young birds are peculiarly tame and unsuspicious. Then they will permit of close approach, will in fact come themselves to inspect the stranger in the woods.

The first migrating golden-crowned sparrow appeared in the lowlands, in Kispiox Valley, on September 1. For a short time thereafter they were fairly common.

Six specimens collected (nos. 42297-42302): two adult males, two juvenal males, and one juvenal female from Nine-mile Mountain; one immature male from Kispiox Valley. The three young (collected July 25, 26) are in juvenal plumage throughout. They are heavily streaked above and below, save on the center of the abdomen, and are generally similar to the same stage in the various races of *Zonotrichia leucophrys*. Compared with juvenal *Z. l. leucophrys*, young *coronata* is darker throughout, the ventral streaking is darker, heavier, and more extensive, and the lateral crown stripes are less plainly indicated.

Compared with young *Z. l. nuttalli* (which is darker-colored than *leucophrys*), young *coronata* is again darker, more reddish dorsally, more heavily streaked ventrally, and with less plainly indicated crown stripes. Tip of bill and most of upper mandible is blackish; base of bill and most of lower mandible, yellowish. Feet are whitish; eyes dark.

**Zonotrichia albicollis** (Gmelin). White-throated Sparrow

An adult male (no. 42303), one of a mated pair, was collected in Kispiox Valley, June 21. The female was seen repeatedly at the same place, a partly cleared pasture with scattered thickets of second growth, and remained there up to the time of our departure, July 15. When we returned late in August, she had gone. This, I believe, is the farthest northwest that this species has been found.

**Spizella monticola ochracea** Brewster. Western Tree Sparrow

One specimen collected (no. 42304), an immature female at Kispiox Valley, September 13. This was evidently a forerunner of the fall migration; the species was not breeding in this general region.

**Spizella passerina passerina** (Bechstein). Eastern Chipping Sparrow

Fairly common in the lowlands about Hazelton when we arrived, May 26, and evidently settled upon the nesting ground. A female collected June 8 had laid part of its set; by the middle of July young out of the nest were seen. The chipping sparrows apparently leave for the south at an early date. By the middle of August their numbers had decreased markedly; one in juvenal plumage, collected August 22, was the last seen. The species was encountered only in the lowlands.

Eight specimens collected (nos. 42305-42312), two adult males, five adult females, one juvenal male. To my eye the chipping sparrow of northern British Columbia is much nearer to the eastern *passerina* in appearance and measurements than to typical *arizonae*.

**Junco hyemalis hyemalis** (Linnaeus). Slate-colored Junco

Seen, not abundantly, during the fall migration. The first was collected August 29; no more appeared until September 13. During the next two weeks they were encountered almost every day. Ten specimens collected (nos. 42316-42325), nine males and one female, all immatures in first winter plumage.

***Junco hyemalis connectens* Coues. Cassiar Junco**

There were a few of this species breeding in Kispiox Valley, twenty-three miles north of Hazelton, the extreme southern limit of the breeding range. *Junco oreganus shufeldti* was the common species, present in large numbers, but at least two pairs of *connectens* were observed, and they were evidently nesting. An adult male (no. 24313) was taken on June 22, and an adult female (no. 42314) with a juvenile (no. 42315) on July 9.

I expected to find *connectens* appearing in numbers at the beginning of the fall migration, but the slate-colored juncos that were collected at that time are nearly all like typical *hyemalis* rather than like our Stikine River series of *connectens* (see Swarth. 1922, p. 243). One specimen (no. 42326), an immature male taken in Kispiox Valley, September 13, does appear to be *connectens*. The female of that form frequently is so much like female *shufeldti* in appearance that the two are distinguished in life with difficulty, which may be one reason why specimens were not taken.

***Junco oreganus shufeldti* Coale. Shufeldt Junco**

Abundant nearly everywhere. On May 26, at Hazelton, a nest was found with eggs just hatching; on June 6 the first young were seen flying about. On July 19 a nest was found, just finished but with no eggs as yet, an unusually late date. On Nine-mile Mountain (July 21 to August 13) a great many juncos were seen, mostly spotted young, frequenting the open slopes and basins immediately above timber line. By the first week in September the molt had been accomplished by most of the juncos and they were then gathered in flocks of from ten to twenty birds. They were present, though in diminished numbers, when I left, the last week in September.

Fifty-four specimens collected (nos. 42327-42380): eight breeding adults (seven males and one female), seventeen in juvenal plumage or undergoing the post-juvenal molt, three adult males and one adult female in winter plumage, and twelve males and thirteen females in immature (first winter) plumage.

This series from the Hazelton region may be taken as representative of conditions at the northwestern limit of the subspecies *shufeldti*. Breeding birds show a tendency toward *Junco hyemalis connectens*, of the country immediately to the northward, exhibited mostly in the grayer dorsum. The flocks of birds in fresh fall plumage yielded no



specimens showing this sort of variation, but they did contain a percentage of individuals with a decided leaning toward *Junco oreganus oreganus*. This might be taken to indicate a slight migratory movement inland at the end of the summer from the region to the westward. Typical *oreganus* inhabits the coastal region less than two hundred miles west of Hazelton. Some of the fall specimens taken, if collected on the coast, might be considered as *oreganus*; they come within the limits of variation of that subspecies, though not exhibiting *oreganus* characters in their extreme.

***Melospiza melodia morphna* Oberholser. Rusty Song Sparrow**

In the immediate vicinity of Hazelton there is not much country suitable for this species and it occurs as scattered pairs in little swales or along small streams. In Kispiox Valley, in the marshes and pastures, it was abundant. None was seen in the mountains. Song sparrows were present, apparently paired and nesting, when we arrived at Hazelton, May 26. A young bird being fed by its parents was seen as late as August 29. By the third week in September the song sparrows were mostly gone; one was seen on September 23.

Twenty-one specimens (nos. 42381-42401) collected, as follows: six breeding adults, one adult in fresh fall plumage, eight immatures in first winter plumage, and six juveniles. (For use of the subspecific name *morphna* for the song sparrow of this region see Swarth, 1923, p. 214.)

***Melospiza lincolni lincolni* (Audubon). Lincoln Sparrow**

Exceedingly numerous in the lowlands; next to the siskin probably the most abundant species of bird. There were some even at the summit of Nine-mile Mountain; young in juvenal plumage were seen there during the fourth week in July.

At Hazelton, male birds singing in the gardens were noted May 30; a young bird just out of the nest was collected June 23; young in completely acquired first winter plumage were taken during the third week in August; an adult nearly through the annual molt, August 26. During the latter part of August, in Kispiox Valley, the species was peculiarly abundant. Fifteen or twenty might be routed out of a thicket at once, and some birds might be found at any point where one cared to search for them. By the second week in September their numbers had decreased markedly; the last was noted on September 14.

Thirteen specimens collected (nos. 42402-42409, 42411-42415): five breeding adults, one adult and four immatures in fresh fall plumage, and three birds in juvenal plumage.

***Passerella iliaca iliaca* (Merrem). Eastern Fox Sparrow**

On September 14, two fox sparrows were shot from a flock of five or six flushed from a thicket. The two collected proved to be of the subspecies *iliaca*, and from the glimpses I had of the others they all appeared to be the same. The two specimens collected (nos. 42416, 42417) are females in completely acquired first winter plumage. One is typical of the subspecies *iliaca* in every respect. The second, though obviously of this same subspecies, is darker colored than the mode, and not so conspicuously streaked on the back. It is more nearly uniform reddish above. Near Hazelton, on September 22, a single fox sparrow (no. 42418) was collected, an immature male. It is closely similar to the second bird just described, perhaps a trifle darker and more uniformly reddish. These birds were undoubtedly migrants from farther north.

The only previous record of the eastern fox sparrow in British Columbia is of a specimen collected at Sicamous, September 25, 1893 (Swarth, 1920, p. 118).

***Passerella iliaca altivagans* Riley. Alberta Fox Sparrow**

Breeding, not abundantly, at and a little above timber line on Nine-mile Mountain. In the same general area as the golden-crowned sparrow and in similar surroundings, though not so much in the balsam thickets as in tangles of alder and veratrum. Constantly heard singing but so shy generally as to avoid observation. The young birds (July 22 to August 13) were flying about; mostly they were in process of change from juvenal to first winter plumage. In Kispiox Valley the first migrating fox sparrow of this subspecies appeared on August 29, and a few more were seen at intervals up to September 7.

Fourteen specimens collected (nos. 42419-42432): on Nine-mile Mountain, two adults (male and female), six in juvenal plumage and in the post-juvenal molt; in Kispiox Valley, three males and three females, all in first winter plumage. These birds, though properly referred to *altivagans* (see Riley, 1911, p. 234), are not typical of that subspecies. In more uniform coloration above and in darker streaking below they show an unmistakable trend toward the darker coastal

rates whose habitat they approach so nearly. There is hardly a trace in any specimen of the obscure dorsal streaking seen in *altivagans* from more southern and eastern stations. The Kispiox Valley migrants are even more questionably referred to *altivagans* than the Nine-mile Mountain specimens. Our collecting station in that valley was northwest of Nine-mile Mountain. Migrating fox sparrows collected there must have traveled from somewhere still farther north, possibly from some region even nearer the coast. These migrating birds in appearance are not unlike some specimens of *sinuosa*. They differ in shape of bill and in darker, less reddish, coloration, especially dorsally. I believe that they are unquestionably intergrades between *altivagans* and the nearby coastal subspecies, *fuliginosa*. When such birds are taken far to the southward, in the winter habitat, it is admittedly difficult to recognize their true relationships (though similar specimens passing through my hands have been hesitatingly labeled *altivagans*), but in this case the place of capture affords a valuable clue. No undoubted specimens of *sinuosa* have been found migrating anywhere in the interior of Alaska or British Columbia.

#### ***Piranga ludoviciana* (Wilson). Western Tanager**

Rather uncommon summer visitant in the lowlands. First noted near Hazelton on June 3, when two were seen and others heard calling. Not more than ten or twelve, all told, seen during the summer, the latest on August 30. Four specimens collected (nos. 42433-42436), an adult male, and three immature males.

#### ***Hirundo erythrogaster* Boddaert. Barn Swallow**

A few pairs were nesting in buildings in Hazelton. Elsewhere, an occasional bird passing overhead was all that was seen. First noted on June 1. On July 20 small flocks were observed flying southward, apparently migrating.

#### ***Iridoprocne bicolor* (Vieillot). Tree Swallow**

Abundant in the lowlands, and already nesting when we reached Hazelton. May 26. Seen entering crevices in buildings in the town, and old woodpecker holes in trees elsewhere. Apparently migrates south at an early date for none was seen after our descent from the mountains, August 14. One specimen collected, an adult male (no. 42437).

**Tachycineta thalassina lepida** Mearns. Northern Violet-green Swallow

The most abundant species of swallow. Like the tree swallow it was nesting when we arrived, the end of May, and, similarly, occupying sites in buildings in town and on the farms. Seen only in the lowlands. The latter part of August the species disappeared, and I supposed had already gone south, but on September 24 and 26 large flocks appeared circling about over Hazelton.

**Stelgidopteryx serripennis** (Audubon). Rough-winged Swallow

Breeds in small numbers about Hazelton and in Kispiox Valley, twenty-three miles to the northward. Present when we arrived, the end of May. Seen only in the lowlands, and not met with after our return from the mountains, the middle of August.

**Bombycilla garrula pallidiceps** Reichenow. Bohemian Waxwing

First seen in Kispiox Valley, July 5. Five birds appeared, and three were collected. They seemed to be birds that had finished nesting. Next encountered August 22, a flock of twenty or more at the same place. During the remainder of our stay flocks numbering from ten to twenty were seen occasionally, generally flying overhead, in Kispiox Valley and about Hazelton. Five specimens (nos. 42438-42442) were collected, all adults. One bird shot August 22 is just beginning the annual molt; another, taken August 27, is in the midst of it. Both these molting birds have new tail feathers (some of them less than half-grown) and in one specimen the yellow-marked wing feathers also are new. It is a curious fact that these yellow markings, especially those on the tail, are not so brilliant in these adult birds as they are in certain nestlings at hand. (For description of these young birds see Swarth, 1922, p. 279.) In the juveniles the tail band is decidedly orange, a color not seen in any other specimen examined, summer or winter. Winter flocks must be composed largely of young of the previous season, and the absence of any birds with orange colored tail band probably means that this color fades appreciably soon after the feathers get their growth. It seems strange, though, that similar changes cannot be traced in the rectrices of the adult.

There is a slight difference in the sexes of the Bohemian waxwing described by Tischler (1918, p. 85) that had apparently escaped the notice of earlier observers. In his opinion the only passably sure mark

of difference lies in the coloration of the throat. In the males the black is darker, more extended and sharply separated from the rest of the underparts. In the females the throat patch is smaller, duller, and not so sharply delimited, fading more gradually into the gray of the underparts. The present writer has tested this character on two occasions, series of Bohemian waxwings being laid out with the labels hidden from view, and the sexes then separated by the above criterion. In each case the division was made without a mistake.

(For use of the name *pallidiceps* see Reichenow, 1908, p. 191.)

### **Bombycilla cedrorum** Vieillot. Cedar Waxwing

On June 17 a small flock was seen near Hazelton. Others were noted in Kispiox Valley a few days later; by the last week in June these flocks were breaking up into pairs. When we returned, the middle of August, nesting was finished and young and old were gathered in flocks once more. During the last two weeks in September cedar waxwings were seen daily about Hazelton.

Seven specimens collected, five adults and two juveniles (nos. 42443-42449). An old bird shot August 22 is just beginning the annual molt; another collected September 5 has finished it. One young bird still in juvenal plumage throughout was collected September 5. One of the two juveniles has small but distinct red tips to four secondaries on each wing, whereas in four of the five adults these markings are utterly lacking.

### **Vireosylva olivacea** (Linnaeus). Red-eyed Vireo

Fairly common in poplar woods near Hazelton. On the evening of June 7 the first arrival was heard singing; the next day a number were encountered. Hazelton is apparently the northern extreme reached by the red-eyed vireo, none being seen in Kispiox Valley, a few miles farther north. Five specimens collected, four adult males and one adult female (nos. 42450-42454).

### **Vireosylva gilva swainsoni** (Baird). Western Warbling Vireo

Fairly common in the lowlands. Present when we reached Hazelton (May 26), and beginning breeding activities. On June 3 a warbling vireo was seen at work at a nest. The species remained in fair abundance through August, leaving rather abruptly at the end of that

month. Last seen September 3. Eight specimens collected, five adult males, and two males and one female in first winter plumage (nos. 42455-42462).

***Vermivora celata celata* (Say).** Orange-crowned Warbler

An orange-crowned warbler in juvenal plumage (no. 42463), collected on the summit of Nine-mile Mountain, July 31, is either of the subspecies *celata* or *orestera*. The young of these subspecies are difficult to distinguish, but as no undoubted examples of *orestera* were taken I am ascribing this individual to the race *celata*, of which other specimens were collected. *Celata* may well have been breeding on Nine-mile Mountain, but the presence of this young bird cannot be taken as proof, for a juvenile *lutescens* also was collected during the same week. It is most unlikely that both subspecies were breeding there, but which (if either) was nesting, and which the migrant, was not ascertained.

Migrating *celata* first appeared in Kispiox Valley on August 26, and until September 14 was of daily occurrence. Eight specimens collected (nos. 42464-42471), three males and five females, all immatures in first winter plumage.

***Vermivora celata lutescens* (Ridgway).** Lutescent Warbler

A young lutescent warbler (commented upon above), in juvenal plumage throughout (no. 42472), was collected at the summit of Nine-mile Mountain, July 24, an immature female in first winter plumage (no. 42473), in Kispiox Valley, August 28. These are all that were seen of this subspecies, and presumably they were migrants from the coast. It is possible, however, that *lutescens* occasionally breeds this far inland, at high altitudes. A bright colored warbler of this species (subspecies uncertain) was seen near Hazelton on May 27, among the last of the spring migrants to pass through.

***Vermivora peregrina* (Wilson).** Tennessee Warbler

A rare summer visitant. A male bird was seen singing near Hazelton on June 2, and another observed in a garden in the town on July 19. On June 22, in Kispiox Valley, a male (no. 42474) was collected, and his mate seen. On July 10, at the same place, a pair of Tennessee warblers was discovered making a great fuss over some young hidden in a thicket nearby. These were the total of records for the summer.

***Dendroica aestiva rubiginosa* (Pallas). Alaska Yellow Warbler**

Yellow warblers were extremely scarce, in notable contrast to the abundance in which I found them on the upper Stikine River, two hundred miles to the northward (see Swarth, 1922, p. 287). Furthermore, the yellow warbler of the upper Stikine is the eastern subspecies, *D. aestiva aestiva*, that of the upper Skeena is the coastal subspecies, *D. aestiva rubiginosa*. The scarcity of this bird in the migrations as well as in midsummer shows that the travels of *aestiva* to and from its more northern breeding ground follow a northwest-southeast line that lies to the eastward of Hazelton.

The first yellow warbler was seen near Hazelton on June 6; from then on a few were encountered from time to time through the summer. On June 23, in Kispiox Valley, a nest was found containing five eggs. On Nine-mile Mountain, the first week in August, several yellow warblers were seen, presumably migrants; during the latter part of the month a very few were observed migrating in Kispiox Valley, the last on August 22.

Five specimens (nos. 42475-42479) collected. Three breeding birds (one male and two females) are unequivocally *rubiginosa*. Two adult females just finishing the annual molt, taken August 19 and 22, respectively, are not so certainly of that subspecies. They may be migrating individuals of *aestiva* from farther north, but their molting condition and the lack of comparable specimens in the several subspecies precludes a decision.

***Dendroica coronata hooveri* McGregor. Alaska Myrtle Warbler**

Myrtle warblers had already passed through on their northward journey when we reached Hazelton, May 26. In the fall they appeared in numbers, abruptly; on September 10 the first one arrived, on the 11th they were abundant. They were still present when I left, September 26. Two specimens collected, immatures in first winter plumage (nos. 42480-42481).

***Dendroica auduboni auduboni* (J. K. Townsend). Audubon Warbler**

Fairly common in the lowlands through the summer, both at Hazelton and in Kispiox Valley to the northward; not seen at high altitudes. Present when we arrived, May 26, and apparently then in pairs. During the first week in September the Audubon warblers

began to disappear. The last to be positively identified as such was seen on September 9, but Alaska myrtle warblers arrived from the north in numbers a day or two later and the two species are sufficiently alike so that a few Audubon warblers might have lingered somewhat later and been overlooked.

Thirteen specimens collected (nos. 42482-42494): nine summer adults (six males, three females), three males in first winter plumage, and one male in juvenal plumage. These birds were taken at the northernmost points at which the Audubon warbler has been found. Two hundred miles farther north, in the Telegraph Creek region, it is replaced by the Alaska myrtle warbler, there near its southern limit (see Swarth, 1922, p. 289). Comparing the two series, *auduboni* from the upper Skeena Valley and *hooveri* from the upper Stikine Valley, there cannot be seen the least approach of one to the other. Specimens of *auduboni* from its northern limit are exactly like others from California; specimens of *hooveri* from its southern limit show no departure from the characters of specimens from northern Alaska. The two species, though closely related, evidently preserve their distinctness where their ranges most closely adjoin. It would be interesting to ascertain if there is any place between Hazelton and Telegraph Creek where both species breed. A hybrid between the two has been described (Taylor, 1911).

### ***Dendroica magnolia* (Wilson). Magnolia Warbler**

Fairly common summer visitant to the lowlands about Hazelton, where it arrived June 3. In Kispiox Valley, June 21 to July 15, it was decidedly rare, not more than five or six birds being seen in that period of time. At the same place when the migration began, the third week in August, magnolia warblers became more numerous and they were seen daily up to the first week in September. Last noted on September 5. Six specimens collected (nos. 42495-42500), two adult males, one adult female, two immature males, one immature female.

### ***Dendroica striata* (J. R. Forster). Black-poll Warbler**

Two immature males (nos. 42501-42502), migrants, were collected in Kispiox Valley on August 18 and September 1, respectively. No others were seen.



***Dendroica townsendi* (J. K. Townsend). Townsend Warbler**

This species may have been breeding in the Hudsonian Zone on Nine-mile Mountain. Two were seen there, one observed in hemlock woods just below timber line on July 30, and one collected on August 5. The latter is still largely in juvenal plumage. Townsend warblers appeared in Kispiox Valley the latter part of August, migrating. First seen August 27, and thereafter, in small numbers, until September 15. Four specimens collected (nos. 42503-42506), one young bird from Nine-mile Mountain and three immature females from Kispiox Valley.

***Seiurus noveboracensis notabilis* Ridgway. Grinnell Water-thrush**

Breeding in fair abundance along marshy streams in Kispiox Valley. A young female mostly in juvenal plumage was collected July 14; a young male but slightly more advanced in the post-juvenal molt was taken August 27. Seven specimens in all collected (nos. 42507-42513), the two juveniles mentioned, two adults (male and female), and three in first winter plumage (two males, one female).

***Oporornis tolmiei* (J. K. Townsend). MacGillivray Warbler**

Abundant summer visitant to the lowlands; one of the commonest birds of the region. First seen on June 6 though possibly present at an earlier date. A nest with four eggs (no. 1856) was found in Kispiox Valley on June 22. Remained in considerable numbers until September; last seen September 14. Three specimens collected (nos. 42514-42516), adult male, adult female, and one bird in first winter plumage.

***Geothlypis trichas occidentalis* Brewster. Western Yellowthroat**

Breeding in fair abundance in Kispiox Valley, but secretive in habit and easily overlooked. Last seen September 12. Eleven specimens collected (nos. 42517-42527), two adults (male and female), four males and four females in first winter plumage, and one male in juvenal plumage.

***Wilsonia pusilla pileolata* (Pallas). Pileolated Warbler**

On May 26 and 27 (our first days at Hazelton), pileolated warblers were migrating abundantly through that region. They then abruptly disappeared, one shot on May 30 being the only other one seen in the spring, and were not found breeding anywhere in the lowlands. An adult male shot near the summit of Nine-mile Mountain, July 30, was just beginning the annual molt. It was one of two birds seen together, perhaps a mated pair nesting there. An immature male taken at the same place August 11 was in first winter plumage throughout, and may have been a migrant. The three were the only birds of this species seen upon the mountain.

The first migrant appeared in Kispiox Valley on August 19. Pileolated warblers were then fairly common until the first week in September; the last was seen September 11. Six specimens in all collected (nos. 42528-42533): two adult (summer) males, one adult male in fresh fall plumage, and three immature males.

***Setophaga ruticilla* (Linnaeus). American Redstart**

Abundant in the lowlands. Present when we reached Hazelton, May 26, and in increasing numbers during the next few days. Several nests were found in Kispiox Valley late in June and early in July, all very similar in structure and location. The usual site was an upright fork of willow or alder, from eight to fifteen feet from the ground. The supporting branches were generally so large as nearly to conceal the tiny nest, or else to make it appear as part of the fork. Nests were in exposed situations more often than in thick shrubbery, sometimes in dead branches, but nevertheless, because of this peculiarity of construction, they were not easy to see. One nest collected (no. 1857, Kispiox Valley, June 27) contained four eggs; others examined held either two eggs or two young birds.

Redstarts remained in fair abundance until the end of August; the last was seen September 8. Unlike some species, of which the adults leave ahead of the young, sometimes before the molt, the adult redstarts seemed to linger quite as late as the juveniles. The adult males, of course, are readily distinguishable, contrary to the rule covering most small birds in the fall, and the number that were seen justifies the statement. An adult female was collected August 29, an adult male September 7. Thirteen specimens in all taken (nos. 42534-42546).

***Anthus rubescens* (Tunstall). Pipit**

A large flock that was seen near Hazelton on May 26 was the last migrating band to pass through. The species was next encountered on the summit of Nine-mile Mountain, where it was breeding in small numbers. A special effort was made there to get birds in the juvenal plumage, but the young were extremely wary, in striking contrast to the tameness of their parents, and only one was collected. Pipits reappeared in the lowlands, in Kispiox Valley, on September 2, and were seen in fair abundance there and at Hazelton until September 20.

In Kispiox Valley, September 4, two pipits were collected, the two together and not otherwise accompanied. One was still mostly in juvenal plumage. The other, in fully acquired winter plumage, I assumed to be an attending parent, but on dissection it proved to be an immature bird. The occurrence is of interest, first, as indicating that a young bird still in juvenal plumage can start to migrate and travel a considerable distance, for the juvenal mentioned must have come a long way from where it was hatched, if only from the nearest mountain top; and secondly, as demonstrating the early age at which a young bird can care for itself, independent of its parents.

Pipits in late March and early April undergo an extensive molt whereby the breeding plumage is acquired. In this plumage the upper parts are grayish, compared with the brown winter plumage, and the lower parts cinnamon buff. The female, as compared with the male, is less gray (more brownish), above, and more heavily spotted below. The cinnamon is evanescent, and by the end of July has almost all faded away. Then, by the fall molt, in late August and early September, the winter plumage is acquired, differing from the breeding garb in being brown above and more heavily streaked below, but, in both old and young, distinctly cinnamon tinged ventrally. Again the cinnamon fades out and by the end of November the birds are dull brown above, and whitish, streaked with dusky below, as we usually see them in their winter home.

Thirteen specimens collected (nos. 42547-42559).

***Dumetella carolinensis* (Linnaeus). Catbird**

On June 10 a catbird was shot within a stone's throw of the railroad station at Hazelton. This bird (no. 42560) was an adult male and in breeding condition, but his mate was not seen, nor was any other of the species encountered during the summer. This, I believe, is a material extension northwestward of the range of this species.

**Troglodytes aedon parkmani** Audubon. Western House Wren

An adult male (no. 42561) was collected in Kispiox Valley on July 2, the only one seen during the summer. It had the appearance of a breeding bird. This is considerably farther north than the species has heretofore been found in British Columbia.

**Nannus hiemalis pacificus** (Baird). Western Winter Wren

Breeding in dense spruce woods on the higher slopes of Nine-mile Mountain. Young out of the nest were seen July 30, and the same day an adult was encountered that was carrying feathers as though engaged in nest building. Winter wrens appeared in the lowlands at the end of the summer. First noted in Kispiox Valley on September 10; others were seen at intervals during the rest of the month. Three specimens collected (nos. 42562-42564), an adult and two juveniles from Nine-mile Mountain.

**Certhia familiaris occidentalis** Ridgway. Tawny Creeper

One in juvenal plumage taken on Nine-mile Mountain, July 29; on August 28 a creeper was seen in Kispiox Valley. These are all that were noted during the summer. The specimen collected (no. 42565) is nearest *C. f. occidentalis* in appearance, though not so reddish above as extremes of that subspecies.

**Sitta canadensis** Linnaeus. Red-breasted Nuthatch

Breeds in small numbers in the lowlands and more abundantly at high altitudes. On Nine-mile Mountain some were seen daily in the hemlock forest just below timber line. A nest was found in Kispiox Valley, placed in a dead stub at the edge of rather dense poplar woods. The stub was perhaps four or five inches in diameter at the base, and was broken off about twenty feet from the ground. The nest hole was near the top and was about one and one-half inches in diameter. On July 12 it contained at least two young birds, nearly ready to fly, whose heads could be seen protruding from the opening. They called incessantly, uttering the characteristic nasal *yang* of the species until either parent appeared, when this was changed to a hissing and squalling, like most other young birds appealing for food.

In August and September red-breasted nuthatches became fairly common in the lowlands, frequently seen in company with chickadees, kinglets, or migrating warblers. One specimen collected (no. 42566), an adult male taken in Kispiox Valley, July 2.

***Penthestes atricapillus septentrionalis* (Harris).**

## Long-tailed Chickadee

Of general distribution in the lowlands though nowhere abundant. Not encountered in the mountains. One specimen still in the juvenal plumage was collected on September 5, but by the last week in August both adults and young had for the most part finished the molt. At that time the species seemed much more abundant than earlier in the year; a flock of chickadees usually served as a nucleus around which were gathered a few individuals of various other species, such as kinglets, warblers, and nuthatches. Seven specimens collected (nos. 42567-42573).

***Penthestes gambeli abbreviatus* Grinnell.**

## Short-tailed Mountain Chickadee

Seen only on Nine-mile Mountain, in spruce and hemlock woods just below timber line, at about 4500 feet altitude. Small flocks seen, on July 30 and again on August 10. Two specimens collected, an adult male (no. 42574) in extremely worn plumage, shot on July 30, and a juvenile female (no. 42575), collected on August 10. (For use of the name *abbreviatus* see Grinnell, 1918, p. 510.)

***Penthestes hudsonicus columbianus* (Rhoads).** Columbian Chickadee

Found only near the summit of Nine-mile Mountain. On July 30 and on August 10 Hudsonian chickadees were seen, each time in company with mountain chickadees. Four specimens collected (nos. 42576-42579), a male and three females, all in juvenal plumage. Eight adults at hand from more southern points in British Columbia (Okanagan, Edgewood, Gold Range, Pearson Mountain, and Mabel Lake) bear out the color characters ascribed to the subspecies *columbianus* (Rhoads, 1893, p. 23; Ridgway, 1904, p. 414) and thus justify the use of that name for the British Columbia Hudsonian chickadee. There are no young birds at hand from the known habitat of *columbianus*, nor any of typical *hudsonicus*, for comparison with the young birds taken on Nine-mile Mountain. The last mentioned, however, are appreciably darker colored than adult *hudsonicus* and of about the same shade as *columbianus*, so it seems safe to regard them as *columbianus*.

***Penthestes rufescens rufescens* (J. K. Townsend)**

## Chestnut-backed Chickadee

Apparently occurs this far inland as a rare migrant in late summer. On August 24 two were seen in Kispiox Valley and one (no. 42580) was collected, a male in juvenal plumage. On September 23 a small flock was encountered near Hazelton and one bird (no. 42581) was shot, a male in first winter plumage.

***Regulus satrapa olivaceus* Baird.** Western Golden-crowned Kinglet

Breeds in small numbers in the lowlands near Hazelton and more abundantly in the nearby mountains. In the valley an occasional pair found shelter in spruces growing about little muskegs, and some were seen in a dense stand of cedar toward the base of Rocher Déboulé. On Nine-mile Mountain the species was rather more abundant; by the end of July flocks of old and young together appeared near our camp. In Kispiox Valley, the second week in September, flocks of golden-crowned kinglets were frequently encountered. Two specimens collected, an adult male near Hazelton, June 3 (no. 42582), and a juvenile male on Nine-mile Mountain, July 31 (no. 42583).

***Regulus calendula calendula* (Linnaeus).** Ruby-crowned Kinglet

In manner of occurrence about the same as the golden-crowned kinglet. In the lowlands, an occasional ruby-crown was heard singing in spruces about the muskegs; on Nine-mile Mountain the species was a little more abundant, in spruce and hemlock forests immediately below timber line. In Kispiox Valley an influx of ruby-crowned kinglets began about September 1. They were not numerous, but one or two could usually be found in the mixed flocks of chickadees and warblers that were then traveling through the woods. Some were seen up to the day of my departure, September 26.

Ten specimens collected (nos. 42584-42593), two adult males and one adult female from Kispiox Valley in June and July, two (male and female) in juvenal plumage from Nine-mile Mountain, and one adult female and one male and three females in first winter plumage from Kispiox Valley in September. These are indistinguishable from specimens of the eastern ruby-crowned kinglet from Illinois and Connecticut. They are not the paler-colored *R. c. cineraceus* of the sierras of California.

**Myadestes townsendi** (Audubon). Townsend Solitaire

Extremely rare, though as one was seen in Kispiox Valley on June 24, the species probably breeds in the region. Others seen on September 2, September 13 (two birds), and September 17, make up the total of observations. One specimen collected (no. 42594), an immature male taken in Kispiox Valley on September 2.

**Hylocichla ustulata swainsoni** (Tschudi). Olive-backed Thrush

Common in the lowlands; not seen at high altitudes. The first arrival was heard singing on June 1; on June 3 olive-backed thrushes were everywhere in the woods. In August they became very scarce, so much so that none was seen for some weeks and I supposed they had already gone south. Then, the last week in August a few reappeared, and, while not abundant, one or two were seen almost daily until late in September. The last was noted on September 21. Eleven specimens collected (nos. 42595-42605), six adult males, two adult females, and three immature males in first winter plumage.

**Hylocichla guttata guttata** (Pallas). Alaska Hermit Thrush

There were a few hermit thrushes on Nine-mile Mountain, breeding in the spruce and hemlock forest immediately below timber line. The song was heard occasionally and at longer intervals a glimpse was caught of one of the birds flitting through the dense shrubbery. Two specimens collected (nos. 42606-42607), both adult males, taken on July 29 and August 10, respectively. They are essentially like breeding birds from the upper Stikine River, and, as with the latter series, are not to be referred to *Hylocichla guttata sequoiensis*, a name that has been applied to the hermit thrush of this general region (see Swarth, 1922, p. 303).

**Hylocichla guttata pallasi** (Cabanis). Eastern Hermit Thrush

During the second week in September a very few migrating hermit thrushes appeared in the woods of Kispiox Valley. Two were shot September 10, and others seen up to September 14. The two collected (nos. 42606, 42607), both immature males in first winter plumage, are obviously not the same as the breeding bird of this region, and appear to be best referred to the eastern subspecies, *Hylocichla guttata pallasi*. They are not so bright reddish dorsally as are most eastern specimens, but they are distinctly more reddish than *guttata*, they are larger than *guttata*, and they have the buffy flanks of *pallasi*. The subspecies

*pallasi* has been reported as breeding at Lac La Hache, British Columbia (Rhoads, 1893, p. 58), and as migrating at Quesnelle (Brooks, 1903, p. 284).

***Planesticus migratorius migratorius* (Linnaeus). Eastern Robin**

Found everywhere in the lowlands; absent from the dense woods of the middle altitudes on the mountains, but reappearing in the open country above timber. When we reached Hazelton, May 26, robins were already sitting on eggs. The first young out of the nest appeared on June 16; by July 1 spotted young were about in numbers. During the second and third weeks in August there was a notable scarcity of robins; by September 1 an influx of migrants had set in, and soon they were as numerous as ever. During the third week in September the southward exodus was in full swing. Day after day migrating flocks of robins trailed overhead, in loosely assembled companies and flying at a great height. There were a good many still around though, up to the time of my departure, September 26.

Eighteen specimens collected (nos. 42610-42627): six breeding adults (four males and two females), seven birds in the spotted juvenal plumage or in the post-juvenal molt, two adult males in fresh winter plumage, and one male and two females in first winter plumage.

I have ascribed this series to the subspecies *migratorius*, the form to which on the whole it bears closest resemblance, but there is considerable individual variation, with obvious intergradation toward the coastal subspecies *caurinus*. It might be that further collecting would show such intergradation to be mostly in breeding birds from this region, while September migrants, presumably from more northern points, are closer to typical *migratorius*. However, spotted young from the Hazelton region are more nearly like young *migratorius* than like *caurinus* at the same stage.

***Ixoreus naevius naevius* (Gmelin). Varied Thrush**

***Ixoreus naevius meruloides* (Swainson). Northern Varied Thrush**

One family of varied thrushes was found in a lowland locality, in Kispiox Valley. They were in a grove of huge cottonwood trees bordering the Kispiox River, a dark, gloomy place, grown up underneath the trees with an impenetrable tangle of devil's-club, thimble-berry, and alder, in appearance just such a jungle as this thrush frequents on the coast. Here, on June 22, a brood of young, out of the nest, were being attended by their parents. The old male was collected (no. 42628).



There were a few varied thrushes breeding on Nine-mile Mountain, in the dense woods just below timber line. An adult female (no. 42629) collected there on July 23 had laid part of its set.

The two specimens mentioned above, the only breeding birds collected, belong to the coastal subspecies, *naevius*. At the end of the summer, migrating varied thrushes of another sort appeared. The first was seen September 1, a week later they were abundant, and there were numbers in the woods about Hazelton (mostly feeding in the sumac bushes) when I left, September 26. These migrating varied thrushes, judging from three males collected (nos. 42630-42632), were of the subspecies *I. n. meruloides*.

### ***Sialia currucoides* (Bechstein). Mountain Bluebird**

A summer visitant to the lowlands, not abundant but of general distribution in the more open country. Present and in pairs when we arrived at Hazelton, the last week in May. The first young bird out of the nest was seen July 4. In August the species disappeared from sight, but early in September a few migrating bluebirds appeared from time to time, and they continued to be seen until September 22, when the last was observed.

Three specimens collected, all adult males (nos. 42633-42635).

### CHECK LIST OF THE MAMMALS

1. *Sorex personatus personatus* I. Geoffroy.
2. *Sorex obscurus obscurus* Merriam.
3. *Microsorex eximius* (Osgood).
4. *Myotis longicrus longicrus* (True).
5. *Mustela cicognani richardsoni* Bonaparte.
6. *Mustela vison energumenos* (Bangs).
7. *Peromyscus maniculatus borealis* Mearns.
8. *Neotoma cinerea saxamans* Osgood.
9. *Synaptomys borealis dalli* Merriam.
10. *Phenacomys intermedius* Merriam.
11. *Eutamias gapperi saturatus* Rhoads.
12. *Microtus drummondi* (Audubon and Bachman).
13. *Microtus mordax mordax* (Merriam).
14. *Ondatra zibethica spatulata* (Osgood).
15. *Zapus saltator* Allen.
16. *Zapus hudsonius hudsonius* (Zimmermann).
17. *Erethizon epixanthum nigrescens* Allen.
18. *Marmota caligata oxytona* Hollister.
19. *Marmota monax petrensis* Howell.
20. *Eutamias amoenus ludibundus* Hollister.
21. *Lepus americanus columbiensis* Rhoads.

## GENERAL ACCOUNTS OF THE MAMMALS

***Sorex personatus personatus* I. Geoffroy. Masked Shrew**

Six specimens collected (nos. 32526, 32528-32530, 32543, 32552), three from Hazelton and three from Kispiox Valley. A female taken at Hazelton on June 7 contained nine embryos.

For identification of the three species of shrews collected, I am indebted to Dr. Hartley H. T. Jackson of the United States Biological Survey.

***Sorex obscurus obscurus* Merriam. Dusky Shrew**

Twenty-two specimens from Hazelton (nos. 32527, 32531-32542, 32544-32551, 32788), six from Kispiox Valley (nos. 32553-32558), and eleven from Nine-mile Mountain (nos. 32559-32569). According to Jackson there are some specimens from each locality that show an approach to *Sorex setosus* Elliot in cranial characters.

On Nine-mile Mountain shrews were trapped on a steep slope just above timber line (4500 to 5000 feet altitude), in dense growths of veratrum, lupine, and grass.

***Microsorex eximius* (Osgood). Osgood Shrew**

A specimen of *Microsorex* (no. 32570) that was collected near Hazelton on June 8 has been provisionally identified by Jackson as *M. eximius*. It measures in millimeters as follows: total length, 88; tail vertebrae, 28; hind foot, 10.

***Myotis longicrus longicrus* (True). Northwestern Long-legged Bat**

Two specimens collected, one at Hazelton, June 18 (no. 32571), and one in Kispiox Valley, July 9 (no. 32572). The Hazelton specimen was found, freshly killed, on the ground under a telephone line. At that point the wire was strung through timber and not easily seen amid the trees, but even so it is noteworthy that this bat should have collided with it. The wire had struck the upper part of the breast and had cut through to the spine; the animal was all but cut in two.

The Kispiox Valley specimen was dislodged from a crack in the trunk of a dead poplar, felled for firewood. The first few blows of

the axe sent it fluttering out, quickly to take refuge in a similar crevice in a nearby tree. Small bats were seen occasionally up to August 21, but not many and always late at night.

***Mustela cicognani richardsoni* Bonaparte. Richardson Weasel**

Five specimens taken (nos. 32573–32577), four males and one female, all from Kispiox Valley. These exhibit the cranial characters of *richardsoni*, as contrasted with the subspecies *alascensis* of the coast (see Merriam, 1896, p. 13). Besides skull variation, there are color differences distinguishing the forms in the summer pelage. The five Kispiox Valley specimens are of a dark, dull brown, close to raw umber, the underparts almost pure white. The *alascensis* series at hand (thirteen summer skins from the coast of southeastern Alaska), are more reddish, the brightest colored specimens close to auburn, and the underparts are often strongly tinged with yellow.

Weasels are probably fairly abundant in the region, for, besides those collected, others were seen at various times. On July 5 one was encountered in the daytime, carrying a freshly killed Drummond meadow mouse. The weasel dropped his prey and escaped in the tall grass; the meadow mouse on examination was found to have the marks of four tiny canine teeth, two in the base of the skull, above, and two in the neck just below the skull. Weasels sometimes took mice from our traps, and, acting on this hint, we were able to catch several in steel traps baited with mice or birds.

***Mustela vison energumenos* (Bangs). British Columbia Mink**

One specimen (no. 32578, adult male) collected in Kispiox Valley, September 4. It is a dark-colored animal, similar to others at hand from the lower Taku River and Wrangell, Alaska, the upper Stikine River, and Seattle. (In this connection see Swarth, 1922, p. 163.)

***Peromyscus maniculatus borealis* Mearns.**

**Northern White-footed Mouse**

Thirty-seven specimens collected near Hazelton (nos. 32579–32615), twelve in Kispiox Valley (nos. 32616–32627), and ten on Nine-mile Mountain (nos. 32628–32637).

The series as a whole is so nearly intermediate between *Peromyscus maniculatus borealis* and *P. m. macrorhinus* that neither name is

satisfactory to use. There are some differences apparent between the series from the three different localities. Among the mice taken at Hazelton there is a preponderance of small, short-tailed, bright-colored specimens (*borealis*-like) and there are no large, long-tailed individuals. From Kispiox Valley and Nine-mile Mountain there are certain large, long-tailed, dark-colored specimens (*macrorhinus*-like), and there is none that is as near typical *borealis* as are some specimens in the Hazelton series. The darker colored mice differ from typical *macrorhinus* in their duller shades; they lack the rich brown apparent in coastal specimens of *macrorhinus*.

Skulls, also, in size and character are variously intermediate between *borealis* and *macrorhinus*. There is individual variation, notably in the series from Nine-mile Mountain, some skulls being generally long and slender, especially as regards the rostrum, others more short and broad.

The differences between the series from Hazelton and those from Kispiox Valley and Nine-mile Mountain are not obviously correlated with geographic position; for Hazelton, with the more *borealis*-like mice, is nearest the habitat of *macrorhinus*, and in a broad valley that leads direct to the coast.

Individual variation obtains in each series to a notable extent. Relative length of tail is a conspicuously variable feature, apparent as soon as the animals were handled. Other variations appeared upon closer study. It may be suggested that two distinct forms are represented in the series under discussion, but in contravention to this idea is the fact that the several distinguishing characters of either subspecies are not always uniformly developed in the same specimen. Size, color, length of tail, and character of skull, are the characters used in differentiating these races, and some individuals possess certain features more nearly like one subspecies, some that are more nearly like the other.

It will take many specimens representing numerous localities in northern and central British Columbia, to demonstrate the distribution and relationships of the forms of *Peromyscus maniculatus* occurring in that general region. In the northern interior of the province is *borealis*, on the northern coast is *macrorhinus*, at the southwest is *oreas*, and at the southeast, *artemisiae*. These subspecies are distinct enough at the centers of their respective ranges, but at the edges of their habitats there are many difficulties in the way of satisfactory allocation of specimens. It will require an immense amount of detailed work to

arrive at an understanding of conditions. Osgood (1909, pp. 50, 52, 59) has commented upon the situation and pointed out some of the difficulties. If, as he asserts, there are places where two subspecies occur together, each in typical form, the problem is even more involved than appears from my own material. I did not find this to be the case in the critical regions worked on the Skeena River or on the Stikine River (see Swarth, 1922, p. 164).

TABLE 2  
MEASUREMENTS IN MILLIMETERS (AVERAGE, MINIMUM, AND MAXIMUM) OF  
ADULT *Peromyscus*

		Total length	Tail vertebrae	Hind foot
<i>Peromyscus m. borealis</i> (10 spec.)	Telegraph Creek, B.C.	170 2 (158-192)	75 3 (65-105)	20 2 (19-22)
<i>Peromyscus m. borealis</i> (10 spec.)	Hazelton, B.C.	176 5 (170-186)	87 3 (75-95)	20 6 (19.5-22)
<i>Peromyscus m. borealis</i> (8 spec.)	Kispiox Valley, B.C.	192 8 (186-210)	97 0 (88-106)	22 0 (21-24)
<i>Peromyscus m. borealis</i> (10 spec.)	Nine-mile Mt., B.C.	190 0 (168-214)	99 0 (79-121)	22 1 (21-23)
<i>Peromyscus m. macrorhinus</i> (10 spec.)	SE. Alaska.	203 3 (197-218)	108 2 (104-116)	24 3 (23-26)

***Neotoma cinerea saxamans* Osgood.** Northern Bushy-tailed Wood Rat

Seven specimens collected (nos. 32699-32705): three adults and two juveniles on Nine-mile Mountain; one adult and one juvenile in Kispiox Valley. They are indistinguishable from specimens from the Stikine River and all are apparently typical of the subspecies *saxamans*.

The local distribution of the bushy-tailed wood rat in this region presents some puzzling features. The animals are abundant in the mountains, where they are preëminently rock dwellers, and it is an easy matter to find sign of their presence in such surroundings. The valleys generally are covered with forest, with dense underbrush beneath the trees, and there are vast areas where no rock formation of any sort is to be seen. In such woods I was never able to find wood rat sign. In many places in these poplar-covered lowlands, however, ranching has been attempted, ground has been cleared and cabins

ected, and wherever a cabin is built the wood rats take prompt possession. Where they come from is not evident, their natural habitations in the poplar woods not being visible, but they are abundant enough to be a decided nuisance.

### ***Synaptomys borealis dalli* Merriam. Dall Lemming Mouse**

One specimen (no. 32641) was trapped in a *Phenacomys* runway at the summit of Nine-mile Mountain (5500 feet altitude), on August 10. *Synaptomys andersoni* was described from the interior of British Columbia to the northward of this region (Allen, 1903, p. 554), and *S. chapmani* from the Selkirk Range of southern British Columbia (Allen, 1903, p. 555). but there probably is not sufficient material extant anywhere to determine the validity of these species. The one lemming mouse at hand from Nine-mile Mountain did not seem to me sufficiently different from the specimens of *dalli* in the collection of the Museum of Vertebrate Zoology to justify the use of another name. Mr. A. Brazier Howell, to whom I forwarded the specimen, making comparison with more extensive series in the United States National Museum, came to the same conclusion.

### ***Phenacomys intermedius* Merriam. Kamloops Phenacomys**

On the summit of Nine-mile Mountain the extensive masses of false heather (*Cassiope mertensiana*) were in places criss-crossed with well defined runways much like meadow-mouse paths in appearance. These runways occurred at scattered intervals, usually in patches of cassiope that were greener than elsewhere, as about the edges of snow banks or little lakes, and they favored also places where there were breaks in the ground, such as a little earth bank or some protruding rocks. They connected tiny holes that ran back into the ground or under rocks; here and there round nests were found, eight or ten inches in diameter, made of soft grass and moss, and not unlike birds' nests in appearance. At intervals there were piles of faeces, in extraordinary amount. Fresh faeces and green cuttings of grass and cassiope were evidence that the runways were in use, but trapping brought meager results. One *Phenacomys*, one *Synaptomys*, and one *Evotomys* was the sum total of two weeks' trapping. The runways I took to be the work of *Phenacomys*, for I had never found similar trails elsewhere where I had trapped the other two species that were taken here.

The specimen of *Phenacomys* above mentioned (no. 32639) was an adult male, taken August 28 at an altitude of about 5500 feet. Two young males (nos. 32638, 32640) were trapped on July 26 and August 11, respectively, in growths of lupine and veratrum just at timber line (about 4500 feet), near our camp.

I am indebted to Mr. A. Brazier Howell for the identification of these three specimens of *Phenacomys*.

### ***Evotomys gapperi saturatus* Rhoads.**

#### **British Columbia Red-backed Mouse**

Found in small numbers in poplar woods at Mission Point, near Hazelton, where eight specimens (nos. 32642-32649) were trapped from June 2 to June 18. Trapping in similar surroundings in Kispiox Valley produced no red-backed mice. One specimen (no. 32650) was taken at the summit of Nine-mile Mountain, about 5500 feet elevation, in a *Phenacomys* runway.

I am indebted to Mr. A. Brazier Howell for the identification of this series of *Evotomys*.

### ***Microtus drummondi* (Audubon and Bachman).**

#### **Drummond Meadow Mouse**

Seventeen specimens collected at Hazelton, twelve in Kispiox Valley, and one on Nine-mile Mountain (nos. 32651-32681). Apparently of general distribution in the lowlands, though not abundant at any point where we trapped. The single specimen from Nine-mile Mountain was caught in a tangle of grass and veratrum just at timber line, about 4500 feet altitude. It was the only one of the species that was seen at that point.

### ***Microtus mordax mordax* (Merriam). Cantankerous Meadow Mouse**

Six specimens, four adult and two juvenile (nos. 32682-32687) trapped at timber line on Nine-mile Mountain. The species was not found in the lowlands. The four adults are distinctly dark colored as compared with *mordax* from the upper Stikine River, and while the series is too small for satisfactory comparison, it apparently illustrates intergradation between *mordax* of the interior and *macrurus* of the coast, such as we found in the meadow mice of the lower Stikine (see Swarth, 1922, p. 175).

***Ondatra zibethica spatulata* (Osgood).** Northwestern Muskrat

Fairly common in Kispiox Valley, where three adults and eight young (nos. 32688-32698) were collected in August and September. These specimens are decidedly dark colored, compared with Alaskan skins, and are probably intermediate toward *osoyoosensis*. In external measurements also they are similarly intermediate according to the figures given by Hollister (1911, pp. 22, 25).

***Zapus saltator* Allen.** Stikine Jumping Mouse

Twenty specimens collected near Hazelton, three in Kispiox Valley, and one on Nine-mile Mountain (nos. 32706-32728, 32731). All are adult. Our latest lowland capture of *Zapus* was on July 13, and up to that time apparently no young were yet born. No nursing females were caught, and only two that were pregnant, one taken on June 14 containing five small embryos, one on June 16, containing six. The one specimen from Nine-mile Mountain (adult female, July 27) was caught in a thick growth of veratrum just above timber line, at about 4500 feet altitude. It is small, compared with lowland specimens, but does not otherwise depart from the characters of *saltator*, and this small size may indicate nothing more than an extreme of variation in the species.

This series of *Zapus saltator* from the Skeena Valley, compared with a somewhat larger series from the upper Stikine Valley, presents no obvious points of difference. In each lot there is considerable variation in color, a number of specimens being noticeably grayish, as compared with a larger proportion of reddish-colored ones.

***Zapus hudsonius hudsonius* (Zimmermann).****Hudson Bay Jumping Mouse**

Two specimens taken near Hazelton, an adult male on June 15, an adult female on June 18 (nos. 32729, 32730). These were caught in the same trap line with the more numerous *Zapus saltator*. They were submitted for identification to Mr. Edward A. Preble, of the United States Biological Survey, who remarks that he "cannot separate them from typical *hudsonius*." In this connection it is of interest to recall the capture by the present writer of a jumping mouse of the *Zapus hudsonius* group (tentatively identified as *Z. h. alascensis*), on Revillagigedo Island, Alaska (see Swarth, 1911, p. 135), which island is



about eighty miles north of the mouth of the Skeena River. Much collecting must be done, and in localities as yet unworked, before an understanding can be reached regarding the distribution and relationships of the species of *Zapus* occurring in the northwest, but certain ideas of Mr. Preble, expressed to me in a letter, seem to point so surely toward a solution of the problem, in its general features, that I append his comments here.

I believe *Z. saltator* to be related to *Z. princeps*, a supposition which is borne out in a measure by its distribution in northern British Columbia. There it supplements in some degree the Rocky Mountain distribution of *Z. princeps*, reaching the coast from the mouth of the Skeena northward. The *Z. hudsonius* group has evidently intruded into British Columbia from the east, being represented by the colony named *Z. tenellus*, and by your Hazelton specimens. Doubtless it covers a wide area. Your Revillagigedo Island (Portage Bay) specimen may represent an intrusion from the north, where *Z. hudsonius* (or *alascensis*) is common. *Zapus h. alascensis*, though recognizable in its typical form, is a rather faintly characterized subspecies, and the Portage Bay specimen, like the Hazelton ones, is very close to typical *hudsonius*.

### ***Erethizon epixanthum nigrescens* Allen. Dusky Porcupine**

Porcupines were abundant at timber line on Nine-mile Mountain. The lowlands are doubtless visited frequently during the winter months, but in summer the species seems to be rather closely restricted to the Hudsonian Zone of the higher mountains. Rock slides, just above the limit of upright timber, evidently form the preferred habitat. The animals were numerous enough to be a decided nuisance. They are nocturnal for the most part, and but few were seen abroad in daylight; activities began at dusk, and during the three weeks we spent upon the mountain there was not one night when we were not disturbed by visiting porcupines.

Three specimens were preserved: no. 32755, skin and skull; no. 32757, skin and skull; no. 32756, complete skeleton. All are adult males. There was great variation in color among the animals we saw; the two skins preserved were taken as representing extremes of light and dark coloration. Number 32757 is very dark, black in general effect, and is doubtless the same sort of animal as served as the type of *Erethizon epixanthum nigrescens* Allen. Number 32755, yellowish in general appearance, is not to be distinguished in color from four California specimens at hand.

Porcupine skulls are said to exhibit great individual variation (see Hollister, 1912b, p. 27), but as far as our series goes, there are cranial characters which can be used to differentiate the animals of British

Columbia and California. In the skulls from British Columbia the nasals are short and the zygomata are rather evenly bowed for their whole length. The skulls from California have longer nasals, and straight, angular zygomata. In the four skulls from California, a straight edge (such as a rule) laid alongside the zygomatic arch will touch the bone for distances of from 20 to 33 millimeters. In the skulls from British Columbia the contact is from 10 to 15 millimeters. There is not much individual variation among the specimens in each series, the four skulls from California, on the one hand, and the three from Nine-mile Mountain on the other. Porcupines from the coast of southeastern Alaska have skulls that most nearly approach the British Columbia type of structure. One from Telegraph Creek, upper Stikine River, is closely similar to the specimens from Nine-mile Mountain.

***Marmota caligata oxytona* Hollister.** Robson Hoary Marmot

Abundant on Nine-mile Mountain, at timber line and higher. Occupied burrows were mostly in the rock slides, but not invariably so. Some were found on sunny slopes that were not especially rocky, one or two in dense spruce woods (not far from openings), and a number that were hidden in thickets of prostrate balsam above the limit of upright timber. Young marmots, a quarter-grown or less were seen during the last week in July. Two such youngsters with their parent were in view daily at the mouth of a burrow a stone's throw from our camp.

Five marmots (nos. 32760-32764) were collected, three adult males and two young females. Besides these I examined eight or ten Indian robes made of about thirty marmot skins each, all from animals killed in the general vicinity of Hazelton. Skins from this region are dark colored ventrally, compared with average *caligata* from the coast of Alaska, and, in the five specimens from Nine-mile Mountain, there is almost complete elimination of the white mark found between the eyes in *caligata*. Otherwise, marmots from the Hazelton region are not markedly different from *caligata* in coloration. The skulls of the specimens from Nine-mile Mountain show the elongation attributed to *oxytona* (Hollister, 1912a, p. 1; Howell, 1915, p. 63), as compared with the broader skull of *caligata*. Thus marmots from the Hazelton region appear to be intermediate between *caligata* and *oxytona*, much like the former in general coloration, like the latter in skull characters.

**Marmota monax petrensis** Howell. British Columbia Woodchuck

A resident of the lowlands of the Hazelton region; possibly common but, from its shyness and the nature of its surroundings, difficult to see. We collected two specimens in Kispiox Valley, all that we encountered, and were told of several others seen nearby. The two collected were an adult female (no. 32758), taken August 21, and a male of the previous year (no. 32759), on September 8. The year following our visit to the region four additional specimens (nos. 32965-32968, three males and one female), were sent me by an acquaintance, Mr. Charles Lindahl, who shot them at the same locality, in May, 1922.

TABLE 3

MEASUREMENTS IN MILLIMETERS OF SKULLS OF *Marmota monax petrensis* FROM KISPIOX VALLEY, B. C.

		Condylor- basal length	Palatal length	Post palatal length	Length of nasals	Zygo- matic breadth	Breadth across mas- toids	Least inter- orbital breadth	Breadth of rostrum	Maxil- lary tooth row
32758	♀	81.8	48.5	30.0	31.5	56.0*	39.8	21.0	16.0	19.2
32968	♀	80.3	47.8	29.8	32.5	55.0	39.5	20.0	14.8	20.0
32759	♂	75.8	45.2	27.0	31.2	53.8	38.2	19.0	14.2	18.5
32965	♂	85.0	50.0	30.5	34.0	56.8	40.5	21.2	15.2	19.0
32966	♂	82.5	49.0	29.0	32.0	57.0	40.0	20.2	14.0	19.2
32967	♂	78.5	46.0	29.0	30.5	55.0	40.0	20.0	15.0	21.0

\*Estimated.

Howell (1915), upon the basis of skulls without skins, ascribes to *Marmota monax ochracea* a range extending south to the Babine Mountains and Stuart Lake, a little southeast of the place where we were collecting. Our specimens, however, are not *ochracea*; in color at least they are widely different from that subspecies. Five of the six are almost uniformly black. The one in 'normal' pelage is in markings closely similar to a Wisconsin specimen of *rufescens* at hand, though darker colored throughout; it has not the cinnamon-colored tail of *ochracea*.

The five black skins came all from the same small clearing on the Kispiox River, but nevertheless the melanism exhibited by them is not to be regarded as peculiar to a limited strain, a single family group. We were told by several people that most of the lowland woodchucks of this general region were black, and that it was only an occasional one that showed the yellow-brown type of coloration. Of

the five black skins, the four taken in May are black throughout save for a more brownish appearance upon the head. The September skin has an infusion of chestnut on neck and shoulders, and scattered white hairs elsewhere.

We had slight opportunity of observing the habits of this wood-chuck, but we were told that the preferred habitat was in clearings, such as were afforded by abandoned ranches. All our specimens came from such places.

### ***Eutamias amoenus ludibundus* Hollister.**

#### **Canadian Mountain Chipmunk**

(Occurs in small numbers in the vicinity of Hazelton. Chipmunks came to the barns and corrals at Mission Point, where we were camped, in fair abundance, attracted by the scattered grain, and they were seen also in the burned over areas toward Rocher Déboulé, but they were absent from the dense woods that cover most of this region. None was seen in Kispiox Valley nor on Nine-mile Mountain.

Five specimens were collected (nos. 32732-32736). These were identified by Mr. A. H. Howell, of the United States Biological Survey.

### ***Sciurus hudsonicus picatus* Swarth. Northwest Coast Red Squirrel**

Twelve red squirrels were collected near Hazelton, five in Kispiox Valley, and one on Nine-mile Mountain (nos. 32737-32754). The squirrel of this region, as exemplified in the series collected, is referable to the coastal subspecies *picatus*; in just one specimen (no. 32742, Hazelton, June 6) is there shown any intergradation toward *hudsonicus*, of the interior.

Squirrels collected about Hazelton during the last week in May, one even as late as June 2, were in winter pelage throughout; one taken on June 16 was in complete summer pelage. Squirrels in the lowlands had entirely finished the molt by the end of June. One that was shot at timber line (4000 feet) on Nine-mile Mountain on August 2 was about midway through the change. (For the use of the name *Sciurus hudsonicus picatus* see Swarth, 1921, p. 92.)

***Lepus americanus columbiensis* Rhoads.****British Columbia Varying Hare**

Twenty-two specimens collected (nos. 32765-32786): sixteen summer adults (skins with skulls), four juveniles, one skeleton (without skin), and one flat winter skin without skull (the gift of an acquaintance). This series seems with fair certainty to belong to the subspecies *columbiensis* (though collected far north of the known range of that form), judging from the characterization of the northwestern hares given by Nelson (1909), and from the appearance of a single specimen (no. 33412), an adult female, taken at Vernon (the type locality of *columbiensis*), November 6, 1922. Specimens from the Hazelton region are essentially like this topotype of *columbiensis*, due allowance being made for seasonal difference. The Skeena Valley hares are small for *macfarlanei*, occurring immediately to the northward (see table of measurements), and, also, in summer pelage the feet are brown. According to Nelson (*op. cit.*, pp. 49, 50, 86), in *macfarlanei* the feet in summer pelage are white, in *columbiensis* they are brown.

Considerable field work and study is still required to arrive at an understanding of the distribution of the species of *Lepus* in British Columbia. Thus, the type locality of *Lepus americanus columbiensis* is Vernon, British Columbia. Nelson records *L. a. columbiensis* from Vernon (1909, p. 104), and *L. bairdi cascadenis* from 'Okanagan' (*op. cit.*, p. 114). Vernon and Okanagan are practically the same locality, Vernon being the principal town in the Okanagan Valley. There is no town of Okanagan, though there is a locality called Okanagan Landing some four miles south of Vernon. Thus Nelson in his text has *L. bairdi cascadenis* and *L. americanus columbiensis* occurring at the same place; in the map of the ranges of these animals (*op. cit.*, p. 85, fig. 8) they are not shown to overlap. If the two forms actually do occur together in any one locality it is a matter of some importance, as bearing upon their specific distinction (see Nelson, *op. cit.*, pp. 84, 85).

There is at hand a specimen of *Lepus* (no. 32789), an adult female, collected by the writer near Okanagan Landing, October 1, 1921, that differs in color and skull from the Hazelton hares and from the specimen from Vernon referred to above, and it is apparently *Lepus bairdi cascadenis*. There may be local differences of environment

separating the two species in this region, or their ranges may really overlap for some distance. More data are required to establish the actual conditions.

We happened to visit the Skeena Valley in a "good rabbit year" and the animals were abundant everywhere in the lowlands. None was seen at high altitudes. In the poplar woods the ground was conspicuously crisscrossed with rabbit trails, and these trails were in constant use. The rabbits themselves were most often encountered about dusk; at that time, too, in a walk through the woods there could be heard again and again the resounding thumps of rabbits' feet, as the startled creatures fled unseen. This alarm note, usually

TABLE 4

MEASUREMENTS IN MILLIMETERS OF *Lepus americanus columbiensis* FROM THE UPPER SKEENA VALLEY, B. C.

		Total length	Tail vertebrae	Hind foot	Ear from notch
32776	♂	438	46	130	76
32778	♂	450	58	133	70
32779	♂	420	42	130	77
32782	♂	451	45	132	65
32777	♀	466	55	138	75
32780	♀	439	41	130	70
32785	♀	445	40	133	70

repeated many times, presumably serves some good purpose, but it seemed as though in this region it could act only as a guide for some pursuing horned owl that otherwise would have had difficulty in following its prey through the bushes.

By the middle of June young rabbits were seen in some numbers, but we found it impossible to shoot them. They were much more active than the adults, and in the tangles of windfall and brush where we saw them, usually close underfoot, they could dart under cover with amazing speed. The juveniles collected were all trapped.

Adults taken early in June still retained some of the white winter pelage. One collected on June 6 is pure white below, the feet are white (with pale cinnamon under-fur), and there are scattered white hairs on the rump and sides. The white lingers longest upon the feet, traces being seen even upon one or two rabbits that were shot in July.

Pregnant females taken on June 1, June 12, and July 11, contained, respectively, eight, one, and five embryos.

By the middle of August rabbits were noticeably less abundant than they had been a month earlier. Then, too, we began to find them dead in the trails, evidently from some disease. It seemed apparent that they were beginning to suffer from the ravages of the epidemic that periodically reduces the northern rabbits, though from all accounts their numbers locally had not yet reached the maximum that was to be expected. This was but the second year of increase since the last period of scarcity, we were told.

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## EXPLANATION OF PLATES

### PLATE 9

Rocher Déboulé Mountain from Hazelton; the Bulkley River in the foreground.  
Photograph taken September 26, 1921.



## PLATE 10

Fig. 1. Woods and clearing in Kispiox Valley. *Marmota monax petrensis* was found in the meadow here shown. Photograph taken September 10, 1921.

Fig. 2. Ridge at the summit of Nine-mile Mountain, about 5000 feet altitude. The thickets are of dwarfed white fir and mountain hemlock. Habitat of caribou and marmot, of ptarmigan, pipit, and golden-crowned sparrow. Photograph taken July 29, 1921.



Fig. 1



Fig. 2

· PLATE 11 ·

Fig. 1. Rock slides at timber line (about 4500 feet altitude), on Nine-mile Mountain. The expedition's camp was located in the tongue of timber extending up the slope in the middle distance. These rocky mountain slides are the preferred habitat of marmot and porcupine, fox sparrows inhabit the thickets, and the Fleming grouse is found at the edge of the big timber. Photograph taken July 25, 1921.

Fig. 2. Upper edge of spruce and hemlock forest at about 4500 feet altitude on Nine-mile Mountain. In these woods (Hudsonian zone) were found Franklin grouse, white-winged crossbill, Hudsonian chickadee, mountain chickadee, and hermit thrush. Photograph taken July 30, 1921.

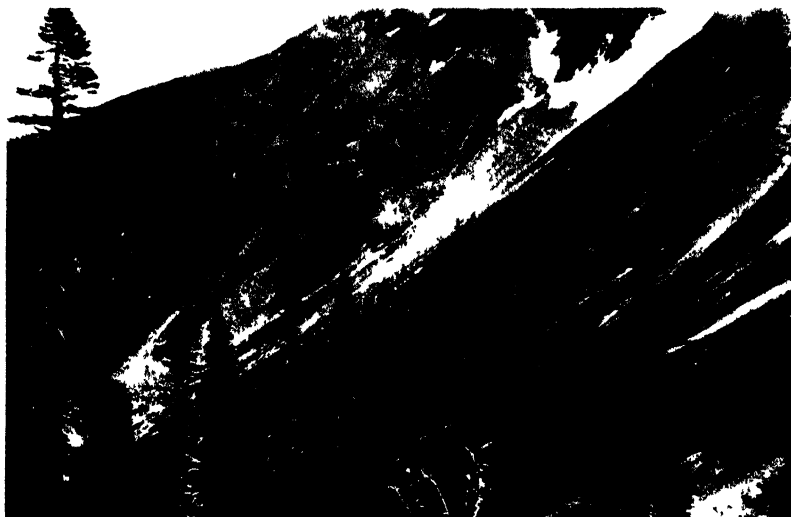


Fig 1



Fig. 2





**REPORT ON A COLLECTION OF BIRDS  
MADE BY J. R. PEMBERTON  
IN PATAGONIA**

**BY  
ALEXANDER WETMORE**

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# REPORT ON A COLLECTION OF BIRDS MADE BY J. R. PEMBERTON IN PATAGONIA

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ALEXANDER WETMORE

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## INTRODUCTION

While engaged in geological field work in Patagonia for the Comisión de Estudios Hidrológicos, under direction of Bailey Willis, Mr. J. R. Pemberton employed leisure hours in studies of the avifauna of the country traversed, to such good purpose that he obtained a collection representative of a majority of the species of the region. Press of other affairs prevented the collector from working up this rich material himself, so he finally presented the entire collection to the Museum of Vertebrate Zoology of the University of California with the request that a report be prepared upon it. At the suggestion of the Director of that institution, the present writer, engaged at the time in identification of a South American collection made personally for the Biological Survey, United States Department of Agriculture, undertook to work over this Pemberton collection, to identify the specimens, and to prepare the following account of it.

Mr. Pemberton informs me that his observations and collections of the birds of this region began soon after his arrival in the territory of Río Negro, in June, 1911. Field work along the line of the Ferrocarril Patagónicos, a railroad projected to extend from San Antonio Oeste, on the coast of Río Negro, to Lago Nahuel Huapí, in the Andes, occupied the time until the close of 1912, and a large number of the specimens were taken during this period. From January to April,

1913, work was extended south into western Chubut through Maitén, Cholila, and Esguel, while in February and March, 1914, and from November, 1914, to the first part of January, 1915, reconnaissance was made south through the Andes as far as the headwaters of the Río Coyle and Río Gallegos in Santa Cruz. The collection contains 349 skins, all accompanied by full data as to place and date of capture. These are representative of 150 species and subspecies, and in a number of cases constitute considerable extensions of previously known ranges. The records form an important addition to knowledge of the avifauna of Patagonia.

#### GAZETTEER OF LOCALITIES

To facilitate the location of the collecting stations, the names of the principal points are listed below in alphabetical order, with some indication of their geographic position. Some of these places are indicated on the accompanying map (fig. A), or may be located there from the data given below. I am indebted for much information on the geography of Río Negro and Chubut to a work on northern Patagonia by Bailey Willis (1914), certain notes have been taken from Peters' paper (1923, pp. 277-284) on the summer birds of northern Patagonia, and Mr. J. R. Pemberton has supplied information regarding points not shown on available maps, has indicated places at which his collections were made, and has read and corrected the account that follows. He has also furnished photographs to illustrate topography of the regions covered by biological field work. It is hoped that interested readers may orient the various places mentioned without undue difficulty.

*Anecon Grande, Arroyo*.—The eastern tributary of the Arroyo Cumallo, draining the northern slopes of the Cerro Anecon Grande.

*Anecon Grande, Cerro*.—A volcanic peak 20 miles west of Huanuluan, rising to an altitude of 2008 meters, the highest point east of the Andes in northern Patagonia. This mountain stands as the summit of a divide between three separate drainage basins.

*Aspero, Cerro*.—A small volcanic hill southwest of Corral Chico. (See fig. C.)

*Bariloche*.—A village in western Río Negro, located on the southern shore of Lake Nahuel Huapi, at its eastern end. It is near the northern border of the forested area of the southern Andes and is the principal settlement of that region. (See fig. A.)

*Belgrano, Río*.—A river of southern Patagonia. Specimens were taken here in Lat. 47° 50' South, Long. 72° West.

*Buenos Aires, Lago*.—A large lake in northwestern Santa Cruz. (See fig. J.)



*Cabeza de Vaca*.—A station on the Ferrocarril Patagónicos, located on an elevated plain about 45 miles west of Valcheta.

*Caracoles*.—A stream of the southern Andes that flows to the northeast. The collecting locality of this name was at Lat.  $47^{\circ} 20'$  South, Long.  $71^{\circ}$  West.

*Carilaufquen, Lago*.—A body of water without outlet, lying 12 miles north of the Patagonian railroad between Maquinchao and Huanuluan. The shore line varies with droughts and rains; in 1911 the lake was recorded as 20 kilometers long by 5 kilometers wide. It receives the combined waters of the arroyos Guaguel Niyeu and Maquinchao, and is distinctly brackish. To the



Fig. B. Tableland near Valcheta, Río Negro, breeding station of pipits and various ground-inhabiting flycatchers. A band of guanaco in the distance. (Photograph by J. R. Pemberton.)



Fig. C. Cerro Aspero, Río Negro, located north of Anecon Grande, in the region of medium relief midway between the Atlantic and the Cordillera. (Photograph by J. R. Pemberton.)

southwest is another lake, known as Carilaufquen Chico, of fresh water, which drains into the larger body of water.

*Chico, Río* (Territory of Río Negro).—A tributary of the Río Chubut in western Río Negro and northwestern Chubut.

*Chico, Río* (Territory of Santa Cruz).—A large stream that rises in the Andes near Lat. 48° South, and flows across central Santa Cruz to the sea. (See fig. E.)

*Cholila, Río*.—A small tributary of the Río Fetaleufu in northwestern Chubut, flowing south through the settlement of Cholila. The stream is a part of the Pacific drainage of this region. (See fig. F.)



Fig. D. A view of Lago Goyet, with a flock of Upland Geese in the water. (Photograph by J. R. Pemberton.)



Fig. E. Valley of the Río Chico, in Santa Cruz, midway between the Atlantic and the Andes. The man is standing beside a nest of the Darwin Rhea (*Pterocnemia pennata*). (Photograph by J. R. Pemberton.)



*Chubut, Río.*—One of the principal streams of Chubut, that rises in the eastern Cordillera in the northwestern part of the territory, near Lat.  $41^{\circ} 30'$  South, flows south to about  $42^{\circ} 21'$ , and then turns southeastward to cross to the Atlantic Ocean. (See fig. G.)

*Cisne, Lago del.*—A small lake in the Cholila valley between Lago del Condor and Lago Mosquitos.

*Condor, Lago del.*—A small isolated lake in northwestern Chubut, 20 miles southwest of Maitén and 20 miles northeast of Lago Rivadavia.

*Corcovado, Río.*—A stream of western Chubut, that rises in Lago General Paz on the Chilian border, and flows to the east, north, and west, to empty eventually into the Pacific Ocean. The Río Hielo, which in turn receives the waters of the Río Frio, is one of its main tributaries. The Corcovado is located near  $44^{\circ}$  South Latitude and is not shown on the accompanying map. (See fig. H.)

*Corral Chico.*—A station on the Ferrocarril Patagónicos, in central Río Negro, nearly 60 miles west of Valcheta.

*Coyle, Río* (also spelled Coile).—A stream that rises in the Cordillera of southwestern Santa Cruz and passes into the sea at Coy Inlet. Specimens were taken January 8, 1915, on the headwaters, near Lat.  $51^{\circ} 05'$  South, Long.  $71^{\circ} 45'$  West.

*Crockett, Laguna.*—A lake of western Río Negro, east and north of Estancia Pilcaniyeu, within the limits of the ranch of that name.

*Cumallo, Arroyo.*—A stream of western Río Negro that heads, in several branches, on the north and northwest faces of Cerro Anecon Grande, and flows northwest and then north to join the Río Limay. Specimens were taken from the head of the arroyo downstream for a distance of 20 miles to the northwest.

*Epuýén, Río.*—A stream of extreme northwestern Chubut, west of Maitén, that carries the waters of Lago Epuýén to Lago Puelo. It is in the Pacific drainage, with the continental divide lying between it and the upper Río Chubut. It is not indicated on the map.

*Esguel.*—A settlement in western Chubut near the head of the Arroyo Esguel, an eastern tributary of the Río Fetaleufu. It lies near Lat.  $42^{\circ} 55'$  South, Long.  $70^{\circ} 20'$  West.

*Esguel, Laguna.*—A marshy lake or series of lakes 10 miles east of Esguel in western Chubut, in Lat.  $42^{\circ} 55'$  South.

*Fetalaufquen, Lago.*—A large lake in northwestern Chubut, about 60 miles south of the boundary line of Chubut and Río Negro. Fetalaufquen lies in a continuation of the same valley that holds Lago Menendez, and has rocky shores, frequently without fringing beaches.

*Fetaleufu, Río.*—A large stream of northwestern Chubut, the outlet of Lago Cholila. It receives the waters of the Río Cholila and flows into the Pacific. It is shown without name on the accompanying map. Specimens were taken in the lower part of the Colonia 16 de Octubre, southwest of Esguel, near Lat.  $43^{\circ} 10'$  South, Long.  $71^{\circ} 35'$  West.

*Fofocahuel.*—A small settlement in the Alto Chubut Valley, in northwestern Chubut. (See fig. G.)

*Frio, Valle.*—A valley of western Chubut, drained by the Río Frio, the northern tributary of the Río Corcovado.

*Gallegos, Río*.—A stream that heads in the Cordillera in extreme southwestern Santa Cruz, and runs east to empty into the Atlantic at Puerto Gallegos.

*General Paz, Lago*.—A large lake that extends across the frontier between Chubut and Chile, near Lat. 44° South.

*Goyet, Lago* (also spelled Coyet).—A small lake in southwestern Chubut, located near Lat. 45° 15' South, Long. 71° 15' West, about 20 miles southeast of Lago Fontana. (See fig. D.)

Fig. F. Near the headwaters of the Río Cholila, Chubut. The trees are the Antarctic beech (*Notofagus pumilio*). (Photograph by J. R. Pemberton.)



Fig. G. Fofocahuel, Chubut, in the fertile upper valley of the Río Chubut, showing a typical breeding ground for birds that seek fresh-water ponds and marshes. The Pre-Cordillera is shown in the background. (Photograph by J. R. Pemberton.)

*Guaguel Niyeu*.—Station on the Ferrocarril Patagónicos, about 40 miles west of Maquinchao near the point where the railroad crosses the Arroyo Guaguel Niyeu, a stream that flows east from the region of Cerro Anecon Grande.

*Hielo, Río*.—A tributary of the Río Corcovado in western Chubut, which receives the waters of the Río Frío. Specimens were taken here January 20, 1913, at the lower end of the Valle Frío, in Lat.  $43^{\circ} 25'$  South, Long.  $71^{\circ} 40'$  West.

*Huanuluan*.—An estancia located, at an elevation of 3100 feet above the sea, near the head of the Arroyo Guaguel Niyeu in western Río Negro, 60 miles west of Maquinchao.



Fig. H. In the valley of the Río Corcovado, Chubut. The conspicuous band of the Antarctic beech forest may be seen on the higher slopes of the mountains in the background. (Photograph by J. R. Pemberton.)

*Las Bayas, Arroyo* (sometimes called Río Las Bayas).—One of the headwaters of the Río Chico in western Río Negro. The Las Bayas rises in the eastern foothills of the Andes about 15 miles south of the eastern end of Lake Nahuel Huapi, and flows east and southeast for a course of about 25 miles. From the north it receives several small tributaries.

*Leleque*.—An estancia in northwestern Chubut in the drainage of the Río Chubut, 20 miles or more south of Maitén.

*Lista, Río*.—A small stream that flows from the Andes in western Santa Cruz to enter the Río Chico (of Santa Cruz) near Lat.  $48^{\circ} 18'$  South, Long.  $71^{\circ} 37'$  West. (See fig. K.)

*Loma Partida*.—A station on the Ferrocarril Patagónicos, immediately west of Valcheta.

*Maitén*.—A small agricultural settlement in northwestern Chubut, in the Alto Chubut Valley, located near Lat.  $42^{\circ}$  South, Long.  $70^{\circ} 10'$  West.

*Menendez, Lago*.—A large lake in northwestern Chubut, northwest of Esquel, at its nearest point about 5 miles west of Lago Rivadavia. Its shores rise precipitously with few points at which a boat may land. In its center is a forest-covered island.

*Mosquitos, Lago*.—A small lake in northwestern Chubut, in Cholila Valley.

*Nahuel Huapi, Lago*.—A lake of surpassing beauty of natural surroundings in northwestern Patagonia, on the boundary line between the territories of Neuquen and Río Negro (Lat.  $41^{\circ}$  South, Long.  $71^{\circ} 30'$  West). The lake has been known for many years, for in the seventeenth century, marauding Spaniards, from the settlements on Chiloë Island, crossed to it over the lost road of Vuriloche. A mission established on Nahuel Huapi by the Jesuits was destroyed in 1655 by Indians.



Fig. I. Undergrowth of bamboo in the beech forest of the Andes.  
(Photograph by J. R. Pemberton.)

*Nahuel Niyeu*.—A station on the Ferrocarril Patagónicos about 20 miles west of Valcheta, located near the Arroyo Nahuel Niyeu.

*Paja Alta*.—A station on the railroad 7 miles east of Valcheta.

*Pichileufu, Río*.—A stream that rises on the eastern slopes of the Andes east of Lago Nahuel Huapi and flows north to join the Limay.

*Pico, Río*.—An Andean stream that drains to the west. Specimens were obtained at Lat.  $44^{\circ} 12'$  South, Long.  $71^{\circ} 21'$  West.

*Pilcaniyeu*.—An estancia located on the Arroyo Pilcaniyeu, 45 miles west-northwest of Huanuluan, and about 35 miles east of Bariloche. Collections were made April 16, 1912, near the estancia house.

*Pilcaniyeu, Arroyo*.—A stream that rises in western Río Negro along the borders of the high plateau east of the Arroyo Pichileufu, flows north to the Estancia Pilcaniyeu, at about  $41^{\circ} 10'$  South Lat.,  $70^{\circ} 40'$  West Long., and then turns west to join the Pichileufu, so that its waters finally reach the Limay.



Fig. J. A view of the immense lava mesa east of Lago Buenos Aires, Santa Cruz, the home of Seed-snipe, the Darwin Rhea, and various taeniopterine flycatchers. A herd of guanaco is shown in the background. (Photograph by J. R. Pemberton.)



Fig. K. The Andean foothills in the basin of the Río Lista, Santa Cruz, home of large Seed-snipe and *Melanodera melanodera princestoniana*. (Photograph by J. R. Pemberton.)

It drains the broken country immediately west of the streams that head on the Cerro Anecon Grande. Specimens were taken on June 8, 1912, about 20 miles south of Estancia Pilcaniyeu.

*Puerto Moreno*.—A gravel beach with a few houses on the southern shore of Lago Nahuel Huapi, 6 miles west of Bariloche. The stream that drains Lago Gutierrez flows into Nahuel Huapi at this point.

*Quemquemtreu, Río*.—A river of northwestern Chubut flowing south into Lago Puelo in the interior Cordilleran valley, about 20 miles west of Maitén. Specimens were taken on this stream on April 14, 1913, in Lat. 41° 55' South, Long. 71° 35' West.

*Rivadavia, Lago*.—A large lake in northwestern Chubut, 40 miles south of the boundary of Río Negro, and about 15 miles from the Chilian frontier. The lake lies in a cañon between Cerro Rivadavia and the main Cordillera.

*Rojo, Cerro*.—A point on the Andean crest, north of Lago Buenos Aires, at Lat. 46° 06' South, Long. 71° 47' West.

*Salado, Arroyo*.—Located about 20 miles north of Corral Chico.

*San Antonio Oeste*.—A seaport of eastern Río Negro, on the Bahía de San Antonio, a northwestern extension of the Golfo de San Matías. The town is the eastern terminus of the Ferrocarril Patagónicos.

*San Martín, Lago*.—A large lake of western Santa Cruz, located near Lat. 49° South.

*Seco, Arroyo*.—A station on the Ferrocarril Patagónicos, between Nahuel Niyeu and Cabeza de Vaca, about 35 miles west of Valcheta. The stream called the Arroyo Seco, also known as the Arroyo Yaminua (so indicated on maps published by Willis) runs northeast.

*Tapilúque, Arroyo*.—An arroyo, south of the railroad, west of Corral Chico. Collections were made at a point about 20 miles southwest of Corral Chico.

*Trineta, Arroyo*.—A stream that heads west of the Arroyo Nahuel Niyeu. Ordinarily the waters of the Trineta sink beneath the surface in its lower course, but in high water it is a tributary of the Nahuel Niyeu.

*Valcheta*.—One of the oldest villages in Río Negro, colonized about 1890, near the Arroyo Valcheta. It is located on the line of the Ferrocarril Patagónicos, about 60 miles west of San Antonio Oeste. (See fig. B.)

*Valcheta, Arroyo*.—A stream that rises 80 kilometers southwest of Valcheta from three large springs in a range of volcanic mountains, and flows through a swampy valley to cross the line of the Patagonian railroad at Valcheta. Beyond this point it is lost in the Laguna del Curico and the surrounding saline flats. The arroyo is of considerable importance in this semi-arid region, as it maintains a constant flow of water through the year.

*Viedma, Lago*.—A large lake of western Santa Cruz, in Lat. 49° 50' South.

## LIST OF SPECIES AND SUBSPECIES

1. *Pterocnemia pennata* (d'Orbigny).
2. *Calopezus elegans elegans* (Is. Geoff. Saint-Hilaire).
3. *Nothura maculosa* (Temminck).
4. *Colymbus chilensis* (Lesson).
5. *Colymbus occipitalis occipitalis* (Garnot).
6. *Aechmophorus major* (Boddaert).
7. *Podilymbus podiceps antarcticus* (Lesson).
8. *Phalacrocorax vigua vigua* (Vieillot).
9. *Phalacrocorax albiventer* (Lesson).
10. *Nycticorax cyanocephalus* (Molina).
11. *Casmerodius albus egretta* (Gmelin).
12. *Ardea cocoi* Linnaeus.
13. *Euxenura galatea* (Molina).
14. *Theristicus melanopsis* (Gmelin).
15. *Plegadis guarauna* (Linnaeus).
16. *Phoenicopterus chilensis* Molina.
17. *Cygnus melancoriphus* (Molina).
18. *Chloephaga leucoptera* (Gmelin).
19. *Chloephaga poliocephala* Selater.
20. *Coscoroba coscoroba* (Molina).
21. *Anas cristata cristata* Gmelin.
22. *Anas specularis* King.
23. *Dafila spinicauda* (Vieillot).
24. *Nettion flavirostre* (Vieillot).
25. *Mareca sibilatrix* (Pöppig).
26. *Querquedula cyanoptera* (Vieillot).
27. *Querquedula versicolor versicolor* (Vieillot).
28. *Spatula platalea* (Vieillot).
29. *Tachyeres cinereus* (Gmelin).
30. *Erismatura vittata* Philippi.
31. *Merganetta armata* Gould.
32. *Vultur gryphus* Linnaeus.
33. *Milvago chimango chimango* (Vieillot).
34. *Polyborus plancus plancus* (Miller).
35. *Ibycter albogularis* (Gould).
36. *Cerchneis sparveria cinnamomina* (Swainson).
37. *Falco fusco-caerulescens fusco-caerulescens* Vieillot.
38. *Circus cinereus* Vieillot.
39. *Buteo polyosoma* (Quoy and Gaimard).
40. *Geranoaëtus melanoleucus* (Vieillot).
41. *Accipiter chilensis* Philippi and Landbeck.
42. *Fulica armillata* Vieillot.
43. *Fulica rufifrons* Philippi and Landbeck.
44. *Parádirallus rufirhynchus sanguinolentus* (Swainson).
45. *Porphyrio melanops melanops* (Vieillot).
46. *Larus dominicanus* Lichtenstein.
47. *Larus maculipennis* Lichtenstein.

48. *Larus glaucoodes* Meyen.
49. *Sterna hirundinacea* Lesson.
50. *Rynchops cinerascens* Spix.
51. *Himantopus melanurus* Vieillot.
52. *Haematopus palliatus durnfordi* Sharpe.
53. *Haematopus leucopodus* Garnot.
54. *Totanus melanoleucus* (Gmelin).
55. *Pisobia bairdii* (Coues).
56. *Capella paraguayae* (Vieillot).
57. *Charadrius falklandicus* Latham.
58. *Zonibyx modestus* (Lichtenstein).
59. *Oreopholus ruficollis ruficollis* (Wagler).
60. *Belonopterus chilensis chilensis* (Molina).
61. *Belonopterus chilensis lampronotus* (Wagler).
62. *Thinocorus rumicivorus rumicivorus* Eschscholtz.
63. *Thinocorus orbignyianus* Is. Geoffroy Saint-Hilaire and Lesson.
64. *Attagis gayi gayi* Is. Geoffroy Saint-Hilaire and Lesson.
65. *Attagis malouinus* (Boddaert).
66. *Metriopelia melanoptera melanoptera* (Molina).
67. *Zenaidura auriculata auriculata* (Des Murs).
68. *Chloroenas araucana* (Lesson).
69. *Microsittace ferruginea* (Müller).
70. *Cyanoliseus patagonus patagonus* (Vieillot).
71. *Tyto alba tuidara* (J. E. Gray).
72. *Strix rufipes* King.
73. *Bubo virginianus nacurutu* (Vieillot).
74. *Glaucidium nanum nanum* (King).
75. *Asio flammeus flammeus* (Pontoppidan).
76. *Speotyto cunicularia cunicularia* (Molina).
77. *Thermochalcis longirostris* (Bonaparte).
78. *Megaceryle torquata stellata* (Meyen).
79. *Dyctiopicus lignarius* (Molina).
80. *Ipocrantor magellanicus* (King).
81. *Colaptes pitius cachinnans* Wetmore and Peters.
82. *Sephanoides galeritus* (Molina).
83. *Geositta cunicularia hellmayri* Peters.
84. *Geositta rufipennis* (Burmeister).
85. *Upucerthia dumetaria dumetaria* Is. Geoff. Saint-Hilaire.
86. *Cinclodes fuscus fuscus* (Vieillot).
87. *Cinclodes patagonicus rupestris* (Kittlitz).
88. *Enicornis phoenicurus* (Gould).
89. *Aphrastura spinicauda* (Gmelin).
90. *Sylviorthorhynchus desmursii* Gay.
91. *Phleocryptes melanops melanops* (Vieillot).
92. *Leptasthenura aegithaloides pallida* Dabbene.
93. *Siptornis sordida sordida* (Lesson).
94. *Siptornis modesta* (Eyton).
95. *Siptornis patagonica* (d'Orbigny).
96. *Siptornis anthoides* (King).
97. *Pseudoscoiura gutturalis* (d'Orbigny and Lafresnaye).
98. *Pygarrhichas albo-gularis* (King).
99. *Scytalopus magellanicus* (Gmelin).



100. *Teledromas fuscus* (Scater and Salvin).
101. *Scelorchilus rubecula* (Kittlitz).
102. *Pteroptochos tarnii tarnii* King.
103. *Agriornis striata striata* Gould.
104. *Agriornis montana* (d'Orbigny and Lafresnaye).
105. *Myiotheretes rufiventris* (Vieillot).
106. *Taenioptera pyrope ignea* Wetmore.
107. *Taenioptera murina* (d'Orbigny and Lafresnaye).
108. *Taenioptera rubetra* Burmeister.
109. *Lichenops perspicillata andina* Ridgway.
110. *Muscisaxicola hatcheri* Scott.
111. *Muscisaxicola frontalis* (Burmeister).
112. *Muscisaxicola macloviana mentalis* d'Orbigny and Lafresnaye.
113. *Muscisaxicola flavinucha* Lafresnaye.
114. *Muscisaxicola capistrata* (Burmeister).
115. *Muscisaxicola maculirostris* d'Orbigny and Lafresnaye.
116. *Lessonia rufa rufa* (Gmelin).
117. *Myiosympotes flaviventris* (d'Orbigny and Lafresnaye).
118. *Spizitornis flavirostris flavirostris* (Scater and Salvin).
119. *Spizitornis parulus curatus* Wetmore and Peters.
120. *Tachuris rubrigastra rubrigastra* (Vieillot).
121. *Elacnia albiceps albiceps* (d'Orbigny and Lafresnaye).
122. *Phytotoma rara* Molina.
123. *Iridoprocne meyeri* (Cabanis).
124. *Pygochelidon patagonica patagonica* (d'Orbigny and Lafresnaye).
125. *Progne elegans* Baird.
126. *Troglodytes musculus magellanicus* Gould.
127. *Troglodytes musculus chilensis* Lesson.
128. *Cistothorus platensis hornensis* (Lesson).
129. *Mimus patagonicus patagonicus* d'Orbigny and Lafresnaye.
130. *Turdus magellanicus pembertonii* Wetmore.
131. *Anthus correndera correndera* Vieillot.
132. *Anthus correndera chilensis* (Lesson).
133. *Trupialis militaris militaris* (Linnaeus).
134. *Notiopsar curaeus* (Molina).
135. *Agelaius thilius thilius* (Molina).
136. *Agelaius thilius chrysopterus* Vieillot.
137. *Molothrus bonariensis bonariensis* (Gmelin).
138. *Sicalis arvensis arvensis* (Kittlitz).
139. *Sicalis lebruni* (Oustalet).
140. *Phrygilus patagonicus* Lowe.
141. *Phrygilus gayi* (Eydoux and Gervais).
142. *Phrygilus fruticeti fruticeti* (Kittlitz).
143. *Phrygilus carbonarius* (d'Orbigny and Lafresnaye).
144. *Phrygilus unicolor plumbeus* (Philippi and Landbeck).
145. *Melanodera melanodera princetoniana* (Scott).
146. *Melanodera xanthogramma xanthogramma* (G. R. Gray).
147. *Diuca diuca* (Molina).
148. *Diuca minor* Bonaparte.
149. *Brachypiza capensis canicapilla* (Gould).
150. *Spinus barbatus* (Molina).

## ANNOTATED LIST

## Order RHEIFORMES

## Family RHEIDAE

***Pterocnemia pennata*** (d'Orbigny)

*Rhea pennata* d'Orbigny, Voy. Am. Merid., Itin., 2, 1834, p. 67. (Bahia San Blas, southern Buenos Aires.)

42,731, Arroyo Trineta, Nahuel Niyeu, Río Negro, June 28, 1911, female..

42,732, 42,735, Arroyo Cumallo, Río Negro, January 18, 1912, skin of adult male, and head and neck of a second one.

42,733, Laguna Crockett, Río Negro, November 13, 1911, female, "probably one week old."

42,734, Lago San Martin, Santa Cruz, December 9, 1914, female, "about one week old."

The first specimen listed, a fully grown female, has the plumage somewhat worn. The legs are feathered on either side down to the middle of the tarsus, and there are 12 or 13 individual scutes on the lower tarsus. From the front of the tarsus the feathering has been worn away except at the extreme upper end.

The adult male preserved complete has the tarsal feathering almost gone and about 15 individual scutes on the front of the tarsus. In both of the birds described the tarsus is folded against the body so that it is difficult to examine its structure.

In the two young the tarsus, on its posterior face, has a broad band of down extending on the outside for a little less than one-third of its length. On the inside a similar line, of narrow width, runs much farther, extending for three-fourths of the length of this segment of the leg. In front, down extends below the head of the tarsus for about one-fourth of its length. Below are rows of short, divided scutes, extending down past the middle, where they become entire and extend clear across the front. The condition is thus quite different from that in *Rhea americana* of similar age, where down does not extend past the tarsal joint, and broad undivided scutes cover the lower three-fourths of the front of the tarsus.

Aside from these structural differences, young of these two rheas closely resemble one another. They are alike in color pattern, save that, when compared with young *americana* from Buenos Aires, *pennata* has the wings and the median stripe of the hind neck darker. (See figs. E and J.)

## Order TINAMIFORMES

## Family TINAMIDAE

***Calopezus elegans elegans* (Is. Geoff. Saint-Hilaire)**

*Eudromia elegans* "D'Orb. et Is. Geoff." Is. Geoff. Saint-Hilaire, Mag. Zool., 1832, cl. II, pl. 1. (Mouth of Río Negro. See Peters, 1923, p. 287.)

42,738, San Antonio Oeste, Río Negro, December 21, 1913, ♀ juv.

42,737, San Antonio Oeste, Río Negro, December 22, 1913, ♂ ad.

42,736, Valcheta, Río Negro, May 7, 1911, ♀.

The immature bird from San Antonio, though only about one-third grown, exhibits the heavier barring on the underparts and darker back that distinguish adults of *elegans* from *C. e. morenoi* Chubb, from the vicinity of General Roca and Neuquen. The adult male is in slightly worn breeding plumage, with a few new feathers appearing on breast and neck. *C. e. elegans* apparently ranges in Patagonia from the mouth of the Río Negro, Valcheta, and the southern border of the Río Negro watershed southward, while it extends north, near the coast, into southern Buenos Aires. (Specimens examined from Mar del Plata.)

***Nothura maculosa* (Temminck)**

*Tinamus maculosus* Temminck, Hist. Nat. Gen. Pig. Gall., 3, 1815, p. 557. (Paraguay.)

42,743, Valcheta, Río Negro, May 7, 1911, female immature.

Hudson and Selater (1872, p. 547) have recorded the spotted tinamou from the valley of the Río Negro, near its mouth, at the northern limit of Patagonia, and the present specimen comes from a point that, if it does not actually mark the southern limit in distribution of the species, must be near that point, as *N. darwini* is the small tinamou found in central Patagonia. The skin from Valcheta is paler and less heavily marked than usual in *N. m. nigroguttata* Salvadori from the central pampas, but as the specimen is very immature no attempt is made to give it a subspecific designation. It may be noted that the tarsus and foot in *N. maculosa* appear longer and heavier than in *N. darwini*.

## Order COLYMBIFORMES

## Family COLYMBIDAE

**Colymbus chilensis** (Lesson)

*Podiceps chilensis* "Garnot" Lesson, Man. d'Orn., 2, June, 1828, p. 358.  
(Concepción Bay, Chile.)

42,758-42,761, Arroyo Seco, Río Negro, August 18, 21, and 24, 1911, two males, two females.

42, 762, Lago Rivadavia, Chubut, March 13, 1913, immature male.

With immature birds the row of pointed scales on the back of the tarsus is yellowish. In proposing a name for this grebe Lesson listed it as *Podiceps chilensis* and again on the same page as *P. americanus*. As the name *chilensis* was given first, it has anteriority over the commonly accepted *americanus* and must be used.

**Colymbus occipitalis occipitalis** (Garnot)

*Podiceps occipitalis* Garnot, Ann. Sci. Nat., 7, January, 1826, p. 50. (Falkland Islands.)

42,756-42,757, Bariloche, Río Negro, March 1, 1912, two males.

The name *Colymbus calipareus* (Lesson and Garnot), 1830, in common use for this species, is antedated by *occipitalis* (Garnot), 1826, as indicated above.

**Aechmophorus major** (Boddaert)

*Colymbus major* Boddaert, Tabl. Planch. Enl., 1783, p. 24. ("Cayenne.")

42,765, San Antonio Oeste, Río Negro, July 5, 1912, immature female.

42,764, Bariloche, Río Negro, March 5, 1912, male.

42,766-42,767, Lago Nahuel Huapi, Río Negro, January 20, 1911, sex not determined (taken by C. L. Nelson).

The male from Bariloche, and one of the skins from Lago Nahuel Huapi, are in handsome, full plumage. The colors of the male in life are noted on labels as, bill black, feet dark tortoise, iris dull red brown.

The present species is only superficially like *Aechmophorus occipitalis* and will probably require removal to another genus. (In regard to this see Ridgway, 1923, p. 373.)

**Podilymbus podiceps antarcticus** (Lesson)

*Podiceps antarcticus* Lesson, Rev. Zool., July, 1842, p. 209. (Valparaiso.)

42,763, Lago Menendez, Chubut, February 26, 1913, female.

An adult in fresh fall plumage.

## Order CICONIIFORMES

## Family PHALACROCORACIDAE

**Phalacrocorax vigua vigua** (Vieillot)

*Hydrocorax vigua* Vieillot, Nouv. Dict. Hist. Nat., 8, 1817, p. 90. (Paraguay.)

42,836, Bariloche, Río Negro, February 27, 1912, adult female.

This specimen is peculiar in having thirteen rectrices, though the normal number for this species is only twelve. The mouth pouch is marked as yellow; iris sky blue and feet black.

**Phalacrocorax albiventer** (Lesson)

*Carbo albiventer* Lesson, Trait. Orn., 1831, p. 604. (Falkland Islands)

42,837, San Antonio Oeste, Río Negro, June 29, 1912, female.

Though this cormorant has been supposed to range only in the far south it has been recorded north to the Río de la Plata (see Doello-Jurado, 1917, p. 15, and Daguerre, 1922, p. 265). The present specimen is immature, with no trace of a crest and the white wing bar only briefly indicated. The pouch is marked as pale yellow, the feet as dull flesh color.

## Family ARDEIDAE

**Nycticorax cyanocephalus** (Molina)

*Ardea cyanocephala* Molina, Sagg. Stor. Nat. Chili, 1782, p. 235. (Chile.)  
42,804, Camp Pilcaniyeu (Arroyo), Río Negro, April 16, 1912, immature female.

42,805, Bariloche, Río Negro, February 26, 1912, immature male.

42,806, Valle Frio, Chubut, January 24, 1913, male.

The first two listed above are in streaked immature plumage, while the third is streaked below, dark grayish brown above, and has two long head plumes. All three are much darker than birds in comparable plumage from more northern regions. Much confusion has prevailed in the identification of South American night herons, but apparently Hartert (1914, p. 15) is correct in calling the paler South American form, *N. n. naevius* (Boddaert), indistinguishable from

that of North America, with *tayazu-guira* (Vieillot) as a synonym. The darker species, to which the three listed above belong, is thus *N. cyanocephalus*. Previously night herons from Patagonia have been called *tayazu-guira*, but *cyanocephalus* ranges east of the Andes, as indicated by Peters (1923, p. 299) from Río Negro. There is in the U. S. National Museum a night heron from Guanacache, Mendoza, that I attribute to *cyanocephalus*, and I am satisfied that, in field work near General Roca, Río Negro, in 1920, I saw *cyanocephalus*; I did not, however, collect it.

### **Casmerodius albus egretta** (Gmelin)

*Ardea egretta* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 629. (Cayenne.)  
42,803, Lago Buenos Aires, Santa Cruz, March 2, 1914, male.

The specimen is a bird of the year with no indication of dorsal plumes. The egret in South America apparently has no fear of cold as the present bird was taken far south at an inclement season.

### **Ardea cocoi** Linnaeus

*Ardea cocoi* Linnaeus, Syst. Nat., ed. 12, 1, 1766, p. 237. (Cayenne.)  
42,802, Río Fataleufu, near Cholila, Chubut, March 14, 1913, female.

This bird is in immature dress. The iris is marked as yellow, the legs and feet dark green brown.

## **Family CICONIIDAE**

### **Euxenura galatea** (Molina)

*Ardea galatea* Molina, Sagg. Stor. Nat. Chili, 1782, p. 235. (Chile.)  
42,801, Valcheta, Río Negro, October 4, 1911, female.

The stomach of this bird contained, in addition to some beetles, a small rail, from which it may seem that the presence of the Maguari stork is not an unmixed blessing to other birds that perforce associate with it.

The current name for the species, *E. maguari*, must be changed to *E. galatea*. The species may be rare at this southern point as it is not included by Peters (1923) in his paper on Summer Birds of Northern Patagonia.

## Family THRESKIORNITHIDAE

***Theristicus melanopis* (Gmelin)**

*Tantalus melanopis* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 653. (Insula novi anni.)

42,800, Bariloche, Río Negro, February 26, 1912, adult male.

The skin of the face and the bill are indicated as greenish black, iris red, feet dull rose. This bird agrees with one described by Salvadori (1900, p. 514) in having a line of feathers between the mandibular rami, below which the throat is entirely bare. In the adult of *T. ecaudatus* (Boddaert) the feathered line is entire and divides the bare gular area into two parts.

***Plegadis guarauna* (Linnaeus)**

*Scolopax guarauna* Linnaeus, Syst. Nat., ed. 12, 1, 1766, p. 242. (Brazil.)  
42,799, Valcheta Creek, Río Negro, May 25, 1911, female.

Like others seen from southern South America, the present specimen is slightly smaller than those from western North America. Measurements of this skin are as follows: Wing, 230.0 mm.; tail, 83.0 mm.; culmen from base, 101.0 mm.; tarsus, 82.0 mm. The bird is in somewhat worn plumage.

## Family PHOENICOPTERIDAE

***Phoenicopterus chilensis* Molina**

*Phoenicopterus chilensis* Molina, Sagg. Stor. Nat. Chili, 1782, p. 242. (Chile.)

42,807, Paja Alta, Río Negro, June 4, 1911, male.

42,808, Valcheta, Río Negro, October 1, 1911, male.

The first one listed, which is fully adult, had the iris white. The second is immature, though fully grown, and has only a hint of the redness of feather characteristic of the fully mature bird.

## Order ANSERIFORMES

## Family ANATIDAE

**Cygnus melancoriphus** (Molina)

*Anas melancoripha* Molina, Sagg. Stor. Nat. Chili, 1782, p. 234. (Chile.)  
42,810, Valcheta, Río Negro, May 3, 1911, female, collected by E. B. Nelson.

The knob on the bill is fully developed and there are caruncles on the adjacent bare skin.

**Chloephaga leucoptera** (Gmelin)

*Anas leucoptera* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 505. (Falkland Islands.)

42,811, Valcheta, Río Negro, May 7, 1911, female.

42,812, Nahuel Niyeu, Río Negro, July 12, 1911, male.

Distinction between females of the present species and *C. dispar* is obscure on the basis of available material, but apparently the bird from Valcheta is *leucoptera* (known formerly as *magellanica*), which is said to have the head distinctly rufescent instead of gray. Two females in the U. S. National Museum, formerly captive birds in the National Zoological Park, have the head much redder than any others, but may have had this color intensified through their enforced environment.

According to Crawshay (1907, p. 96) *C. inornata* King must be replaced by *C. dispar* (Philippi and Landbeck), as King's *Anas inornatus* appears to be *C. hybrida*. Several superspecific groups have been proposed for upland geese, but all appear untenable except *Taenidiestes* Reichenbach for *hybrida*, which may be separated as a subgenus on its decidedly larger feet and relatively shorter tarsus. (See fig. D.)

**Chloephaga poliocephala** Sclater

*Chloephaga poliocephala* Sclater, Proc. Zool. Soc. London, 1858, p. 128. (Chiloë Island.)

42,813, Río Chubut, Leleque, Chubut, April 9, 1913, male.

Fully adult. The plumage is worn in places but there is no indication of molt except that the primaries seem to have been renewed.



**Coscoroba coscoroba** (Molina)

*Anas coscoroba* Molina, Sagg. Stor. Nat. Chili, 1782, p. 234. (Chile.)  
42,809, Valcheta, Río Negro, May 28, 1911, female.

An adult bird in full winter plumage.

**Anas cristata cristata** Gmelin

*Anas cristata* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 540. (Statenland.)  
42,814, Lago Carilaufquen, Río Negro, November 14, 1911, male.

*Lophonetta*, set up by Riley (1914, p. 100) as a genus for *Anas cristata*, is distinguished from typical *Anas* by a hair-like nuchal crest alone, as the other characters assigned to it do not hold. The rectrices in *Anas* number 18, except in the male mallard which possesses 20, the Laysan teal (placed by Oberholser in the genus *Horizonetta*) which has 16, *Anas sparsa* (which I have not seen but which Mr. J. L. Peters has examined for me) which has 16, and *Anas specularis* (data from Mr. Peters) and *A. cristata* which have 14. *Anas specularis* thus agrees with *cristata* in number of rectrices and serves to bridge the apparent gap between *cristata* and the other members of the genus *Anas*. Further, in *A. specularis* the feathers of the nape are slightly elongated with the web somewhat disintegrated at the tips, thus suggesting the nuchal crest of *cristata*. The elongate, pointed tail of *cristata* is notable, but is not greatly different from the tail of *Anas luzonica*. In view of these facts it seems best to consider *Lophonetta* as only a well marked subgenus.

**Anas specularis** King

*Anas specularis* King, Zool. Jour., 4, 1828, p. 98. (Straits of Magellan.)  
42,815-42,816, Bariloche, Río Negro, March 7 and 8, 1912, females.

One of these, perhaps younger than the other, has the white in front of the eye restricted to an oval area an inch long, and the longitudinal throat streak of white greatly narrowed. The other, apparently fully adult, has the white much more extensive. (See pl. 12.)

***Dafla spinicauda* (Vieillot)**

*Anas spinicauda* Vieillot, Nouv. Dict. Hist. Nat., 5, 1816, p. 135. (Buenos Aires.)

42,819, Valcheta, Río Negro, May 3, 1911, female.

42,820, Arroyo Seco, Río Negro, August 21, 1911, male.

In the male of this species the speculum is green, while in the female it is brown; otherwise both sexes are similar and resemble the female of *Dafla acuta*, but are browner above.

***Nettion flavirostre* (Vieillot)**

*Anas flavirostris* Vieillot, Nouv. Dict. Hist. Nat., 5, 1816, p. 107. (Buenos Aires.)

42,824, Valcheta, Río Negro, May 7, 1911, male.

In full winter plumage.

***Mareca sibilatrix* (Pöppig)**

*Anas sibilatrix* Pöppig, Fror. Not., 25, no. 529, July, 1829, p. 10. (Chile.)

42,817-42,818, Valcheta, Río Negro, May 2 and 7, 1911, male and female.

The female has not completed the molt.

***Querquedula cyanoptera* (Vieillot)**

*Anas cyanoptera* Vieillot, Nouv. Dict. Hist. Nat., 5, 1816, p. 104. (Río de la Plata and Buenos Aires.)

42,825, Valcheta, Río Negro, April 28, 1911, adult male.

42,826, Valcheta Creek, Río Negro, May 21, 1911, female.

These birds are in full winter plumage. Specimens from South America, on minute comparison, appear, so far as may be seen, exactly like those from the western United States.

***Querquedula versicolor versicolor* (Vieillot)**

*Anas versicolor* Vieillot, Nouv. Dict. Hist. Nat., 5, 1816, p. 109. (Paraguay.)

42,822-42,823, Arroyo Las Bayas, Río Negro, May 27, 1912, male and female.

The green in the speculum is less vivid in the female than in the male.

***Spatula platalea* (Vieillot)**

*Anas platalea* Vieillot, Nouv. Dict. Hist. Nat., 5, 1816, p. 157. (Paraguay.)  
42,821, Valcheta Creek, Río Negro, May 21, 1911, male.

An adult bird in full winter plumage. The label states that the feet were yellow, spotted with black; bill glossy black.

***Tachyeres cinereus* (Gmelin)**

*Anas cinerea* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 506. (Falkland Islands and Staten Island.)

42,829-42,831, Lago Fetalaufquen, Chubut, February 8 and 19 and March 11, 1913, adult and immature males and female.

A male, taken February 8, has molted the primaries and is renewing the body plumage. An immature male half grown, shot February 19, has the contour feathers developed except on the middle of the back and rump where a mouse-brown down persists. The primaries and secondaries are barely emerging from their sheaths. A female, marked adult, but apparently a bird of the year, shot on March 11, is in full winter plumage and has a wing 255 mm. long that from all appearances might enable flight.

The question of specific entity among the flying and non-flying steamer ducks is one that is far from settlement. The specimens above are called *cinereus* in the belief that there is only one form. Attention is called to two recent papers on the subject, one by Blaauw (1916, pp. 488-492) where two species are discriminated, mainly through alleged differences in the bill, and a second by W. S. Brooks (1917, pp. 155-157) where all are considered one species.

***Erismatura vittata* Philippi**

*Erismatura vittata* Philippi, Arch. für Naturg., 1860, pt. 1, p. 26. (Chile.)

42,827, Loma Partida, Río Negro, June 18, 1911, female.

42,828, Río Fetalufo, Chubut, February 3, 1913, male.

The bill in the male is marked as delft blue in life.

***Merganetta armata* Gould**

*Merganetta armata* Gould, Proc. Zool. Soc. London, 1842, p. 95. (Andes of Chile, Lat. 34°-35° South.)

42,832, Bariloche, Río Negro, March 8, 1912, female.

42,834, Río Quemquemtreu, Río Negro, April 14, 1913, immature male.

42,833, Río Epuyén, Chubut, March 24, 1913, female.

42,835, Río Cholila, Chubut, March 18, 1913, adult male.

The two females are in the usual gray and cinnamon plumage. The immature male is white below with a few scattered markings of cinnamon, and the adult male is in full plumage. All have the tips of the rectrices much worn. The series as a whole appears darker, with the light markings on the back more restricted, than the few skins seen from central Chile. Colors on the labels of the Patagonian skins are as follows: No. 42,832, female, iris brown, bill red, except for brown ridge (on culmen), feet dark red, webs black; No. 42,834, immature male, upper mandible black, lower red, inner side of tarsus, upper surface of feet and webs yellow, outer side of tarsus and lower surface of toes black; No. 42,835, adult male, feet and bill dark red, wing spurs black, webs and lower surface of toes black.

**Order FALCONIFORMES****Family CATHARTIDAE*****Vultur gryphus* Linnaeus**

*Vultur gryphus* Linnaeus, Syst. Nat., ed. 10, 1, 1758, p. 86. (Chile.)

42,838, Pilcaniyeu, Río Negro, June 11, 1912, male.

42,839, Aguada "Isquiel," Río Negro, October 25, 1911, female.

Both specimens are fully adult. The male has the spread of wings marked as 2.97 meters (which is equivalent to approximately 9 feet 9 inches). Few definite figures for wing spread of the condor are available and the extent is frequently greatly exaggerated, as the above represents about the maximum size. Darwin (in Gould and Darwin, 1838, p. 4) cites one with an extent of 8½ feet.

## Family FALCONIDAE

**Milvago chimango chimango** (Vieillot)

*Polyborus chimango* Vieillot, Nouv. Dict. Hist. Nat., 5, 1816, p. 260. (Paraguay.)

42,844, Valcheta, Río Negro, April 28, 1911, sex not indicated.

42,845, Lago Mosquitos, Cholila, Chubut, March 18, 1913, male.

The skin from Chubut is much darker than the average for typical *chimango*, and shows a near approach to *M. c. temucoensis* Selater of southern Chile. With larger series for comparison it may prove that birds from Chubut are best allocated with this western form.

**Polyborus plancus plancus** (Miller)

*Falco plancus* Miller, Var. Subj. Nat. Hist., 1777, pl. 17. (Tierra del Fuego.)

42,841, Valcheta Creek, Río Negro, May 25, 1911, male.

This skin is an individual in full plumage, with a wing measurement of 432 mm., in size agreeing with the average of the southern typical race of this caracara. The extent of wings is marked as 54 inches. In life, the feet and face were orange yellow.

**Ibycter albogularis** (Gould)

*Polyborus (Phalcobaenus) albogularis* Gould, Proc. Zool. Soc. London, 1837, p. 9. (Río Santa Cruz, Santa Cruz, about Lat. 50° South.)

42,842, Upper Arroyo Las Bayas, Río Negro, June 4, 1912, male.

42,843, Maitén, at Río Chubut, Chubut, April 13, 1913, female.

In the original description Gould recorded this bird merely from Santa Cruz. Darwin, however (Gould and Darwin, January, 1839, p. 20), says "seen during the ascent of the river Santa Cruz (Lat. 50° S.) to the Cordillera; but not one individual was observed in any other part of Patagonia."

The specimen from the upper Arroyo Las Bayas is in full immature plumage, of which I do not find previous description. It is so different in color from the adult that it might be mistaken for a distinct species. In general coloration it is strikingly similar to *Milvago chimango* (though easily recognized by its greater size) except that it is darker, but when critically examined it is found to differ in heavier shaft streakings on the feathers and in other ways.

It is darker and less rufescent than *I. megalopterus* (Meyen) of the same age. Though *albogularis* and *megalopterus* are similar in size and general appearance they are found to differ in both adult and immature plumage in the form of the crown feathers. In *albogularis* these are slender, elongate, and recurved slightly at the tip, and are comparatively firm in texture. In *megalopterus* the crown feathers are also recurved but are broader, looser in structure, and tend to become slightly twisted so that they appear as a fluffy mass that forms a distinct crown cap.

The skin from Maitén is in full adult plumage except that one outer tail feather is brown and mottled as in the immature, and there are some brownish tipped feathers on the side of the rump. The feet and tarsi are marked as lemon yellow, the face orange, the bill blue gray, and the iris slate. (See pl. 13.)

The species seems rare in the north as Peters (1923, p. 304) recorded it near Huanuluan, Río Negro, on only two occasions.

Scott (1910, p. 152) has described a hawk of this type from Chubut as *Ibycter circumcinctus*, characterized by a narrow black band, in which some of the feathers are partly white, that extends across the chest. In two adults of *albogularis*, including the one from Maitén, there is a slight encroachment of black on the sides of the chest, giving the impression of an interrupted band. At either end the dark feathers are somewhat mixed with white. Though Scott's *circumcinctus* may represent a valid form, it is more probable that it is an individual variant of *albogularis*. It may be recalled that *I. megalopterus* has the chest and throat wholly black when adult.

### ***Cerchneis sparveria cinnamomina* (Swainson)**

*Falco cinnamominus* Swainson, Anim. Menag., 1838, p. 281. (Chile.)

42,852-42,853, Bariloche, Río Negro, February 24, 1912, male and female.

42,854-42,855, Río Fataleufu, Chubut, February 3, 1913, male and female.

These specimens are all in partial molt. They exhibit the large size, narrow subterminal black tail band, single band on the external web of the outer rectrix, and mixture of rufous at the ends of the rectrices characteristic of *cinnamomina* as contrasted with *C. s. australis* (Ridgway). They are similar to a small series examined from Chile. The four listed have the following measurements: Males, wing, 193.0 to 197.0 mm.; tail, 136.5-140.0 mm. Female (one defective bird not measured), wing, 197.0 (tail imperfect).

**Falco fusco-caerulescens fusco-caerulescens** Vieillot

*Falco fusco-caerulescens* Vieillot, Nouv. Dict. Hist. Nat., 11, 1817, p. 90.  
(Paraguay.)

42,856, Upper Arroyo Las Bayas, Río Negro, June 4, 1912, female.

42,857, Lago Mosquitos, Cholila, Chubut, March 19, 1913, female.

These two represent the typical form, distinguished from *F. l. septentrionalis* Todd, of North America, by slightly smaller size, particularly of bill. The wing measurement in the two listed respectively is 280.0 and 297.0 mm. The first one contained remains of a parrot in its stomach.

## Family ACCIPITRIDAE

**Circus cinereus** Vieillot

*Circus cinereus* Vieillot, Nouv. Dict. Hist. Nat., 4, 1816, p. 454. (Paraguay and Río de la Plata.)

42,848, Maitén, Río Chubut, Chubut, April 13, 1913, immature female.

42,847, Lago Mosquitos, Cholila, Chubut, March 19, 1913, immature male.

42,846, Leleque, Chubut, December 15, 1912, adult male.

The stomach in the adult male contained lizards, according to an inscription on the label.

**Buteo polyosoma** (Quoy and Gaimard)

*Falco polyosoma* Quoy and Gaimard, Voy. Uranie Physicienne, Zool., August, 1824, p. 92, pl. 14. (Falkland Islands.)

42,850, Arroyo Salado, Río Negro, July 17, 1911, male.

42,851, Lago Mosquitos, Cholila, Chubut, March 21, 1913, female.

Both specimens are in full adult plumage. Kirke Swann (1921-1922, pp. 85-86) has recognized several forms of this species but material now at hand does not permit their proper diagnosis. Skins from Patagonia should represent the typical subspecies. The bird has been known formerly as *Buteo erythronotus* (King).

**Geranoaëtus melanoleucus** (Vieillot)

*Spizaëtus melanoleucus* Vieillot, Nouv. Dict. Hist. Nat., 32, 1819, p. 57.  
(Paraguay.)  
42,840, Huanuluan, Río Negro, November 16, 1911, female.

This skin is a fully grown specimen with a wing measurement of 530.0 mm. The extent of wing is indicated on the collector's label as 1.77 meters. The iris was hazel brown. The bird exhales a strong odor of skunk, suggesting that one of these animals had furnished it a meal.

Kirke Swann (1921-1922, p. 67) has described a form ranging from Patagonia and Chile to northwestern Argentina as *G. m. australis* (type locality Valle del Lago Blanco, Chubut), which is said to differ from the typical bird of Paraguay in barred underparts. *G. m. melanoleucus* is indicated by this author as pure white on the breast and belly with bars only on the under tail and under wing coverts. The skin from Huanuluan is heavily cross barred below and seems to indicate the validity of *australis*.

**Accipiter chilensis** Philippi and Landbeck

*Accipiter chilensis* Philippi and Landbeck, Anal. Univ. Chile, 24, April, 1864, p. 346. (Chile.)  
42,849, Río Fetalefufu, Chubut, February 4, 1913, male.

A fine specimen in full adult plumage, with the following measurements: Wing, 205.0 mm.; tail, 164.5 mm.; culmen from cere, 13.5 mm.; tarsus, 59.0 mm.

**Order GRUIFORMES****Family RALLIDAE****Fulica armillata** Vieillot

*Fulica armillata* Vieillot, Nouv. Dict. Hist. Nat., 12, 1817, p. 47. (Paraguay.)  
42,754, Loma Partida, Río Negro, June 18, 1911, male.

This is an adult specimen of the largest species of coot found in Patagonia.



***Fulica ruffrons* Philippi and Landbeck**

*Tulica ruffrons* Philippi and Landbeck, Anal. Univ. Chile, 19, no. 4, Oct, 1861, p. 507. (Chile.)

42,755, Loma Partida, Río Negro, June 18, 1911, male.

The present species is distinguished from *F. armillata* by smaller size (particularly of the feet), and smaller frontal shield, which is narrow and pointed posteriorly, and colored red.

***Pardirallus rytirhynchos sanguinolentus* (Swainson)**

*Ballus sanguinolentus* Swainson, Anim. Menag., 1838, p. 335. (Chile.)

42,750, Caracoles, Santa Cruz, March 30, 1914, female.

This specimen has a distinct reddish spot at the base of the lower mandible and is not different from a small series from Chile. It has the following measurements: Wing, 134.0 mm.; tail, 76.6 mm.; tarsus, 45.0 mm.; culmen from base, 52.0 mm. The type locality of *sanguinolentus* has been restricted by Chubb (1919, p. 51) to Chile, in a review of the forms of *rytirhynchos*. *P. vigilantis* (Sharpe), from the Straits of Magellan, is said to resemble true *rytirhynchos* in having the centers of the dorsal feathers black, instead of uniform as in *sanguinolentus*, but is described and figured without red at the base of the bill.

***Porphyriops melanops melanops* (Vieillot)**

*Ballus melanops* Vieillot, Nouv. Dict. Hist. Nat., 28, 1819, p. 553. (Paraguay.)

42,751, Arroyo Las Bayas, Río Negro, May 21, 1912, male.

42,752-42,753, Río Epuyén, Chubut, March 24, 1913, females.

One of the females is fully adult, the other birds are immature. The adult is darker than a few others seen from farther north in Argentina, and has a slight amount of chestnut in the interscapulum. The axillars, however, are crossed by distinct dark bars. *P. m. bogotensis* Chapman (1914, p. 169), named from the Savanna of Bogotá, Colombia, which I have not seen, is said to have the axillars white. The species, though widespread in range, is one that is seldom taken.

## Order CHARADRIIFORMES

## Family LARIDAE

**Larus dominicanus** Lichtenstein

*Larus dominicanus* Lichtenstein, Verz. Doubl. Zool. Mus. Berlin, 1823, p. 82. (Coast of Brazil.)

42,770-42,771, San Antonio Oeste, Río Negro, June 29 and July 3, 1912, adult and immature males.

42,768-42,769, Bariloche, Río Negro, February 25 and March 6, 1912, adult male, immature female.

The southern black-backed gull is common on the southern coasts of South America, and in the interior is reported by Dabbene at Lago General Paz in Chubut (taken by Gerling). The species has a wide range in the southern hemisphere. Mathews and Iredale have listed the New Zealand bird as *L. d. antipodus* (Bruch), and Fleming (1924, p. 139) has described *austrinus* as a new race from South Shetland. The few skins from New Zealand that I have seen show no evident difference from individuals from South America.

The immature male taken is about to molt into adult plumage. The head and nape have a few markings of brown, and there is a little brown on the sides though otherwise the bird is pure white below. The immature female from Bariloche below is heavily streaked with brown. The two adults are in full plumage.

Colors in living birds are recorded as follows: Adult male, eyelid carmine, iris gray, bill amber, tip of lower mandible carmine; feet pale green gray.

Adult male, feet pale olive green, bill yellow, gonys red.

Immature male, bill brown and gray, feet pale olive gray.

Immature female, feet brownish gray, bill irregularly marked with brown, iris pale brown gray.

**Larus maculipennis** Lichtenstein

*Larus maculipennis* Lichtenstein, Verz. Doubl. Zool. Mus. Berlin, 1823, p. 83. (Montevideo.)

42,772, San Antonio Oeste, Río Negro, July 1, 1912, male.

A specimen in full winter plumage.

**Larus glaucoodes** Meyen

*Larus glaucoodes* Meyen, Nov. Act. Acad. Caes. Leop.-Carol. Nat. Curios.,  
16, suppl., 1834, p. 115, pl. 24. (Coast of Chile.)  
42,773, Arroyo Seco, Río Negro, September 6, 1911, female.

This is a species of southern range here near its northern limit. The bird is in nearly adult plumage, with a blush of red suffused over the lower surface. The feet, eyelid, bill, and inside of mouth are marked as dark carmine, iris orange red.

**Sterna hirundinacea** Lesson

*Sterna hirundinacea* Lesson, Trait. d'Ornith., 1831, p. 621. (Coast of Brazil.)  
42,774, San Antonio Oeste, Río Negro, December 9, 1913, male.

A common species on the coast of Argentina.

## Family RYNCHOPIDAE

**Rynchops cinerascens** Spix

*Rynchops cinerascens* Spix, Av. Sp. Nov. Brasiliam, 2, 1825, p. 80, pl. 102.  
(Río Amazons, Brazil.)  
42,775, Laguna Esquel, near Esquel, Chubut, January 6, 1914, young male.

There are few definite records for the skimmer in the interior of Patagonia, and I have seen no mention of it from Chubut except at the coast.

## Family RECURVIROSTRIDAE

**Himantopus melanurus** Vieillot

*Himantopus melanurus* Vieillot, Nouv. Dict. Hist. Nat., 10, 1817, p. 42.  
(Paraguay.)  
42,794, Valcheta, Río Negro, October 4, 1911, male.

This specimen, in fully adult plumage, was said in life to have the feet and legs carmine and the bill black. In a small series of these stilts I can see no differences between birds from Paraguay and those from Peru, Chile, or Argentina.

## Family HAEMATOPODIDAE

***Haematopus palliatus durnfordi* Sharpe**

*Haematopus durnfordi* Sharpe, Cat. Birds Brit. Mus., 24, 1896, p. 117, pl. 6.  
(Tambo Point, mouth of Río Chubut, Chubut.)  
42,781, San Antonio Oeste, Río Negro, June 29, 1912, female.

This specimen is identified in accordance with the studies of Dr. R. C. Murphy on the American oystercatchers (1925, p. 7).

***Haematopus leucopodus* Garnot**

*Haematopus leucopodus* Garnot, Ann. Sci. Nat., 7, January, 1826, p. 47.  
(Falkland Islands.)  
42,780, Beagle Channel, Tierra del Fuego, December 20, 1914, taken by  
L. C. Decius.

A fully adult bird. The species is listed by Sharpe (1896, p. 113) as *Haematopus leucopus*: the proper designation is as above.

## Family SCOLOPACIDAE

***Totanus melanoleucus* (Gmelin)**

*Scolopax melanoleuca* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 659. (Chateau Bay, Labrador.)  
42,795, Valcheta Creek, Río Negro, May 21, 1911, male.

The presence of this bird at the date mentioned may be explained only on the basis that it was a crippled individual unable to migrate, or a non-breeder without the necessary impulse for its return journey to the northward. It is in worn winter plumage.

***Pisobia bairdii* (Coues)**

*Actodromas bairdii* Coues, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 194.  
(Fort Resolution, Great Slave Lake, Canada.)  
42,796, Arroyo Seco, Río Negro, September 6, 1911, female.

This seems to be an early date for the arrival of this North American migrant since Peters (1923, p. 297) did not record it at Huanuluan, Río Negro, until September 12.

**Capella paraguaiae** (Vieillot)

*Scolopax paraguaiae*, Vieillot, Nouv. Dict. Hist. Nat., 3, 1816, p. 356.  
(Paraguay.)

42,797, Paja Alta, Río Negro, June 4, 1911, male.

42,798, Lago Fetalaufquen, Chubut, February 12, 1913, female.

Mathews and Iredale (1920, p. 131) have shown that *Capella*, of Frenzel, published in 1801, has priority over the familiar *Gallinago*, of Koch, 1816.

## Family CHARADRIIDAE

**Charadrius falklandicus** Latham

*Charadrius falklandicus* Latham, Ind. Orn., 2, 1790, p. 747. (Falkland Islands.)

42,789, San Antonio Oeste, Río Negro, July 1, 1912, female.

42,787, Nahuel Niyeu, Río Negro, July 12, 1911, male.

42,788, Bariloche, Río Negro, February 28, 1912, female.

P. R. Lowe in a recent review of certain anatomical features in the plovers (1922, p. 489) places the Falkland plover in the genus *Leucopoliis*.

**Zonibyx modestus** (Lichtenstein)

*Charadrius modestus* Lichtenstein, Verz. Doubl. Zool. Mus. Berlin, 1823, p. 71. (Montevideo.)

42,790-42,791, Head of Río Gallegos, Santa Cruz, January 6, 1915, adult and juvenile females.

The immature bird appears fully grown and is in juvenal plumage.

**Oreopholus ruficollis ruficollis** (Wagler)

*Charadrius ruficollis* Wagler, Isis, 1829, p. 653. (Canelones, Uruguay.)

42,783, Arroyo Seco, Río Negro, September 8, 1911, male.

42,782, 42,784, Cabeza de Vaca, Río Negro, September 16, 1911, males.

42,786, Arroyo Anecon Grande, Río Negro, December 14, 1911, juvenile female.

42,785, Río Belgrano, Santa Cruz, November 9, 1914, sex not determined.

The specimen from Santa Cruz is a partial albino with head, neck, back, and under surface almost entirely white, and white markings in the wings. The juvenile example from Arroyo Anecon Grande has the ends of the primaries barely projecting from the developing

sheaths, and the natal down persistent on sides of head, rump, tail, and thighs. A description of it follows: Crown blackish mouse gray, each feather margined laterally with cartridge buff; sides of head, including broad superciliary region and band on hind neck, whitish, spotted finely with blackish and washed with clay color; ear coverts and indistinct malar stripe clay color; feathers of back and wing coverts drab to dull Isabella color, tipped with cartridge buff, with a shaft stripe and subterminal posterior border of dull blackish, the shaft stripe in part indistinct or lacking; rump mottled with clay color, dull black, and whitish; rectrices clay color banded with dull black and cartridge buff; throat whitish; foreneck washed with clay color; upper breast light grayish olive, the feathers tipped with cream-buff; lower breast and sides pale cinnamon-buff, with a blackish spot in center; abdomen white; thighs buffy white, barred with blackish.

***Belonopterus chilensis chilensis* (Molina)**

*Parra chilensis* Molina, Sagg. Stor. Nat. Chili, 1782, p. 258. (Chile.)  
42,793, Lago Mosquitos, Cholila, Chubut, March 19, 1913, male.

This specimen has the sides of the head gray and the black throat markings extensive, as is characteristic of this form. The bird has the following measurements: Wing, 244.0 mm.; tail, 122.0 mm.; culmen, 31.0 mm.; tarsus, 63.5 mm.

***Belonopterus chilensis lampronotus* (Wagler)**

*Charadrius lampronotus* Wagler, Syst. Av., pt. 1, 1827, p. 74. (Paraguay.)  
42,792, Valcheta, Río Negro, April 28, 1911, female.

This specimen is from near the southern limit of range for this subspecies, as farther west, at Huanuluan, it is replaced by *B. c. chilensis*.

**Family THINOCORIDAE**

***Thinocorus rumicivorus rumicivorus* Eschscholtz**

*Thinocorus rumicivorus* Eschscholtz, Zool. Atlas, pt. 1, 1829, p. 2, pl. 2.  
(Concepción Bay, Chile.)  
42,778-42,779, Arroyo Seco, Río Negro, September 6 and 7, 1911, male and female.

These are closely similar to specimens from Chile. The male, when fresh, is said to have had the feet yellow.

***Thinochorus orbignyianus* Is. Geoffroy Saint-Hilaire and Lesson**

*Tinochorus orbignyianus* Is. Geoffroy Saint-Hilaire and Lesson, Cent. Zool., 1831, p. 137, pl. 48. (Santiago, Chile.)

42,777, Huanuluan, Río Negro, December 7, 1911, female.

42,776, Arroyo Anecon Grandé, Río Negro, December 24, 1911, male.

These two are adults. They do not differ from skins from Peru.

***Attagis gayi gayi* Is. Geoffroy Saint-Hilaire and Lesson**

*Attagis gayi* Is. Geoffroy Saint-Hilaire and Lesson, Cent. Zool., 1831, p. 135, pl. 47. (Santiago, Chile.)

42,739, Cerro Rojo, Santa Cruz, February 28, 1914, female.

42,740-42,741, Planicie south of Lago Buenos Aires, Santa Cruz, March 11, 1914, adult and juvenile males.

These appear darker and more rufescent than two specimens from the type locality, but the latter, taken in the sixties, are hardly in comparable condition. (See fig. K.)

***Attagis malouinus* (Boddaert)**

*Tetrao malouinus* Boddaert, Tabl. Planch. Enl., 1783, p. 13. (Falkland Islands.)

42,742, Arroyo Pilcaniyeu, Río Negro, June 8, 1912, female.

The present specimen has the lower breast and abdomen white, but otherwise differs somewhat from the published description of *malouinus*, as the dorsal surface is, in general, dull black, relieved by innumerable fine markings of cartridge buff and whitish with a slight mixture of cinnamon-buff, and the upper breast and foreneck are whitish marked heavily with blackish. It is closely similar to the figure given by Crawshaw (1907, p. 131). P. R. Lowe has named what appears, from his abbreviated description, to be a somewhat similar specimen, from Valle del Lago Blanco, Chubut, *Attagis cheeputi* (1921, p. 104) but with no other skins available for comparison I have called the Pemberton specimen *malouinus*. It is apparently the most northerly of known records for the species.

## Order COLUMBIFORMES

## Family COLUMBIDAE

**Metriopelia melanoptera melanoptera** (Molina)

*Columba melanoptera* Molina, Sagg. Stor. Nat. Chili, 1782, p. 236. (Chile.)  
42,749, Arroyo Anecon Grande, Río Negro, December 26, 1911, male.

This specimen when killed had the cere red-orange, the eyes emerald green. It was said to have flushed from a nest containing eggs.

**Zenaidura auriculata auriculata** (Des Murs)

*Pristera auriculata* Des Murs, in Gay, Hist. Fis. Pol. Chile, Zool., 1, 1847, p. 381. (Central provinces of Chile.)  
42,746, Valcheta Creek, Río Negro, May 28, 1911, male.  
42,747-42,748, Río Fetaleufu, Chubut, February 3, 1913, male and female.

These are very slightly paler above than are birds from central Argentina.

**Chloroenas araucana** (Lesson)

*Columba araucana* Lesson, Voy. Coquille, Zool., libr. 4, July, 1827, pl. 40, (Talcahuano, Province of Concepción, Chile.)  
42,744, Puesto Moreno, Lago Nahuel Huapi, Río Negro, March 1, 1912, female.  
42,745, Río Corcovado, Chubut, January 12, 1913, male.

The two are apparently adult, as both have a clearly marked white band across the back of the head. The female differs from the male in slightly smaller size, in paler hue of reddish brown, in suffusion of gray on breast, and in restriction of reddish brown on the scapulars.



## Order PSITTACIFORMES

## Family PSITTACIDAE

**Microsittace ferruginea** (Müller)

*Psittacus ferrugineus* Müller, Vollst. Natursyst. Suppl., 1776, p. 75.  
(Straits of Magellan.)

42,875-42,877, Upper Arroyo Las Bayas, Río Negro, June 3, 1912, two males, one female.

Published records that I have seen all refer to more southern points than the one given above, so that the Pemberton specimens appear to mark the known northern limit for the species. The most northern point for the species in literature that I have encountered is that by Hartert (1909, p. 234) of a female shot by Koslowsky, May 21, 1899, at Lago Blanco, Chubut.

**Cyanoliseus patagonus patagonus** (Vieillot)

*Psittacus patagonus* Vieillot, Nouv. Dict. Hist. Nat., 25, 1817, p. 367.  
(Buenos Aires.)

42,873-42,874, Valcheta Creek, Río Negro, May 25, 1911, males.

These two have the bright coloration of the under surface and the dimensions characteristic of the typical form. *C. l. andinus* Dabbene and Lillo, of northwestern Argentina, is marked by duller more suffused coloration below, particularly on the abdomen, and *C. l. byroni* (J. E. Gray) of Chile by larger size, particularly of the bill.

One of these specimens is indicated as having had the iris and skin around the eye white and the feet pale flesh color.

## Order CORACIIFORMES

## Family TYTONIDAE

**Tyto alba tuidara** (J. E. Gray)

*Strix tuidara* J. E. Gray, in Griffith ed., Cuvier's Animal Kingdom, 6, 1829, p. 75. (Brazil.)

42,861, Nahuel Huapí, Río Negro, January 3, 1913, female, taken by C. L. Nelson.

As *Strix perlata* Lichtenstein 1819 (in common use for this bird) is antedated by *Strix perlata* Vieillot 1817 for another species, the name for this barn owl becomes *tuidara*. The bird differs from the North American form in the dark gray of the upper surface.

## Family STRIGIDAE

**Strix rufipes** King

*Strix rufipes* King, Zool. Jour., 3, 1827, p. 426. (Port Famine, Straits of Magellan.)

42,872, Río Hielo, Chubut, January 20, 1913, female.

This specimen is fully adult and is darker in color than the only other specimen seen, an immature individual. The stomach, according to the collector's label, contained remains of small rodents.

**Bubo virginianus nacurutu** (Vieillot)

*Strix nacurutu* Vieillot, Nouv. Dict. Hist. Nat., 7, 1817, p. 44. (Paraguay.)

42,859, Río Pichileufu, Río Negro, May 31, 1912, female.

42,858, Bariloche, Río Negro, February 24, 1912, immature female.

42,860, Upper Arroyo Las Bayas, Río Negro, June 3, 1912, female.

As *Bubo magellanicus* of Gmelin (1788, p. 286), although it applies to the present owl, is simply given as a variety under the species *Strix bubo*, it cannot be taken as valid from that point. Likewise *Bubo magellanicus* of Daudin (2, 1800, p. 210), though on first glance apparently a definite name, on investigation proves to be merely variety *F.* under *Strix bubo* and so without standing. The first definite name applied to this owl seems to be *nacurutu* Vieillot, 1817. The three specimens listed vary somewhat in depth of color but offer no differences worthy of mention.

***Glaucidium nanum nanum* (King)**

*Strix nana* King, Zool. Jour., 3, 1827, p. 427. (Port Famine, Straits of Magellan.)

42,865-42,867, Lago Mosquitos, Chubut, March 18 and 19, 1913, two females, one male.

42,864, Río Fetaleufu, Chubut, February 4, 1913, male.

42,862-42,863, Valle Frío, Chubut, January 21 and 24, 1913, two females.

These birds have the dark bands on the tail broader than is the case in specimens from the Straits of Magellan (the type locality for the typical form) but are nearer to true *nanum* than to *vafrum* Wetmore (1922, p. 323) from central Chile. In the male from Río Fetaleufu the iris is marked as "red-orange," and the stomach content noted as grasshoppers. Two from Valle Frío had the iris indicated as yellow, while the stomach content in one is recorded as large grasshoppers, and in the other as "hummingbird moths, etc." Three of the skins taken are in rufescent, and three in grayish plumage.

It is highly probable that specimens will be secured eventually that will establish *nanum* as a subspecies of *Glaucidium brasilianum*, as the two groups are separated by differences in intensity of coloration alone.

Intergradation between *nanum* and *vafrum* takes place apparently in western Río Negro according to specimens secured by Peters (1923, pp. 307-308) near Bariloche, in the vicinity of Lake Nahuel Huapí, which I have examined. Two immature females shot January 30 and 31, 1921, in typical South Andean forest, about one mile west of Bariloche, have the tail band similar to that of true *nanum*. A male killed February 11, 1911, on the Arroyo Piscicultura, seven miles east of the town of Bariloche, in more open country where true forest is replaced by heavy brush along streams, agrees with *vafrum* in having the dark bands on the tail twice as wide as the light ones, but is slightly smaller. From this scanty evidence it may prove that transition between these two subspecies may be somewhat abrupt, as at this point the heavy southern forests give way to open country where tree growth is represented only by scattered thickets, a change in ecological conditions that may control the distribution of the birds in question.

***Asio flammeus flammeus* (Pontoppidan) .**

*Strix flammea* Pontoppidan, Danske Atlas, 1, 1763, p. 617, pl. 25. (Sweden.)  
42,871, San Antonio Oeste, Río Negro, May 10, 1913, male.

The short-eared owl of South America, in accordance with Bangs' outline of the species (1919, p. 96), should be known as *Asio f. brevicaudis*, distinguished by larger bill and slightly paler color above. I cannot see, however, that the present specimen, and others that I have examined, offer characters not found in a series from North America.

***Speotyto cunicularia cunicularia* (Molina)**

*Strix cunicularia* Molina, Sagg. Stor. Nat. Chili, 1782, p. 263. (Chile.)  
42,868-42,870, Arroyo Las Bayas, Río Negro, May 25, 1912, two males and one female.

These appear similar to Chilean specimens.

**Family CAPRIMULGIDAE*****Thermochalcis longirostris* (Bonaparte)**

*Caprimulgus longirostris* Bonaparte, Jour. Acad. Nat. Sci. Philadelphia, 4, pt. 2, no. 12, 1825, p. 384. (Brazil.)  
42,881, Arroyo Tapilque, Río Negro, October 21, 1911, female.  
42,883, Arroyo Cumallo, Río Negro, February 2, 1912, male.  
42,882, Pilcaniyeu, Río Negro, January 4, 1912, sex (?).

The male is darker throughout than the female, and is distinguished further by greater extent of white in the tail, and white instead of buff on the outer primaries.

**Family ALCEDINIDAE*****Megaceryle torquata stellata* (Meyen)**

*Alcedo stellata* Meyen, Nov. Act. Acad. Caes. Leop.-Carol. Nat. Curios., 16. Suppl., 1834, p. 93, pl. 14. (Banks of Río Clado, Province of San Fernando, Chile.)  
42,879, Lago Mosquitos, Cholila, Chubut, March 20, 1913, female.  
42,878, Río Fetaleufu, Chubut, January 27, 1913, male (?).

These two specimens have the back strongly spotted with white as is characteristic of the subspecies *stellata*. Miller (1918, pp. 352-353) has shown that *Streptoceryle*, which has been used as a genus for the larger American kingfishers, is not sufficiently distinct from *Megaceryle* to warrant its maintenance as a valid group.

## Family PICIDAE

**Dyctiopicus lignarius (Molina)**

- Picus lignarius* Molina, Sagg. Stor. Nat. Chili, 1782, p. 236. (Chile.)  
42,887-42,889, Upper Río Las Bayas, Río Negro, June 3 and 4, 1912,  
male and two females.  
42,890, Lago Fetalafquen, Chubut, February 12, 1913, male juvenile.  
42,891, Río Pico, Chubut, January 24, 1914, male.

An immature male, with a few red tips still remaining on the feathers of part of the crown, is whiter below than older specimens. The plumage of winter birds is heavier and more lax than in summer skins, indicating a heavy feather growth to enable the birds to withstand the rigors of a Patagonian winter. Specimens from central Chile have somewhat broader, heavier bills than the series here discussed, while a female from Laredo Bay, Straits of Magellan, in the U. S. National Museum, agrees with Patagonian skins in this respect. The series from Chile is inadequate and it is not considered advisable at present to distinguish these modifications as forms. Should this course be taken later the name *Picus melanocephalus* King (1831, p. 14), described from the Straits of Magellan and Chiloë Island, may be available for the southern and eastern form. Measurements in millimeters of the series collected by Pemberton are as follows: Males (three specimens): Wing, 94.0-95.3 (94.6); tail, 57.5-59.5 (58.0, from two specimens only); exposed culmen, 22.0-22.6 (22.3); tarsus, 19.0-20.5 (19.8). Females (two specimens): Wing, 91.0-94.1 (92.5); tail, 55.0-59.0 (57.0); exposed culmen, 19.4-19.5 (19.4); tarsus, 18.7-19.0 (18.8).

**Ipocrantor magellanicus (King)**

- Picus magellanicus* King, Zool. Jour., 3, 1828, p. 430. (Port Famine, Straits of Magellan.)  
42,892-42,893, Lago Nahuel Huapi, Río Negro, January and February 9,  
1912, shot by C. L. Nelson.

From the plumage it appears that one of these is a male and the second a female. They seem to constitute a northern extension of range for the species. There is no indication on which side of the lake the birds were taken.

**Colaptes pitius cachinnans** Wetmore and Peters

*Colaptes pitius cachinnans* Wetmore and Peters, Proc. Biol. Soc. Washington, 35, March 20, 1922, p. 43. (Bariloche, Río Negro, altitude 2500 feet.)

42,884-42,885, Bariloche, Río Negro, February 24 and 26, 1912, male juvenile.

42,886, Lago del Condor, Cholila, Chubut, March 19, 1913, female.

The immature birds are fully grown; they have the feathers of the crown tipped with grayish and show the faintly indicated malar stripe that distinguishes adult males from females. These three specimens bear out fully the characters of shorter bill and more heavily barred underparts assigned in the original diagnosis of this race of the Chilean flicker. The adult female has the following measurements: Wing, 157 mm.; tail, 113.4 mm.; exposed culmen, 32.5 mm.; tarsus, 29.6 mm. The exposed culmen in the males measures 34.6 and 35.6 mm. respectively. (See pl. 14.)

## Family TROCHILIDAE

**Sephanoides galeritus** (Molina)

*Trochilus galeritus* Molina, Sagg. Stor. Nat. Chili, 1782, p. 247. (Chile.) 42,880, Lago Menendez, Chubut, February 24, 1913.

This specimen does not have the sex indicated but seems to be a female. The genus name *Eustephanus* of Reichenbach (1850), in common use for this species, is antedated by *Sephanoides* G. R. Gray, proposed in 1840 (1840, p. 14) with *Trochilus kingii* Vigors (= *T. galeritus* Molina) as type.

## Order PASSERIFORMES

## Family FURNARIIDAE

***Geositta cunicularia hellmayri* Peters**

- Geositta cunicularia hellmayri* Peters, Occ. Pap. Boston Soc. Nat. Hist., 5, January 30, 1925, p. 145. (Huanuluan, Río Negro, Argentina.)  
42,999-43,000, Arroyo Seco, Río Negro, August 17 and 24, 1911, males.  
43,001, Guaguel Niyeu, Río Negro, November 14, 1911, male.  
43,002-43,003, Lago del Cisne, Cholila, Chubut, March 18, 1913, male and female.

This series shows slightly greater size than is found in specimens of typical *cunicularia* from the Province of Buenos Aires and from Uruguay, being about equivalent in measurement to skins seen from central Chile. In color these skins from Patagonia are slightly grayer than those from the north, and browner than those from the west.

The specimens treated here have the following measurements: Males (four specimens): Wing, 94.0-101.0 (97.1); tail, 52.0-56.4 (54.2); exposed culmen, 15.8-18.5 (17.2); tarsus, 22.5-23.6 (23.2).

The male secured November 14, 1911, at Guaguel Niyeu, is indicated as parent of a set of eggs.

***Geositta rufipennis* (Burmeister)**

- Geobamon rufipennis* Burmeister, Jour. für Ornith., 1860, p. 249. ("Paraná." Dr. Dabbene [1919, p. 133] has substituted Cordillera de Mendoza.)  
42,997, Head of Arroyo Cumallo, Río Negro, January 17, 1912, male.  
42,998, Maitén, Río Chubut, Chubut, April 15, 1913, male.

The subspecies of *Geositta rufipennis* are in such confusion that with material at hand it is not advisable to identify the present specimens beyond the species. The two listed above are of the type with avellaneous underparts (brighter on the sides), and agree in color with two smaller specimens from Chile in the U. S. National Museum that are probably *G. r. fasciata* (Philippi and Landbeck). The two from Patagonia are, however, much darker than a single skin from Potrerillos, Mendoza, near the locality suggested by Dabbene as the probable point from which Burmeister procured the typical form. Dr. Hellmayr informs me that he has examined Burmeister's types of *rufipennis* in the Halle Museum and that they are of the light-breasted form similar to skins from Tilcará, Tucumán, and Maimará, Jujuy. The two birds secured by Pemberton measure as follows: Wing, 107.0-108.5 mm.; tail, 57.5-60.0 mm.; exposed culmen (one-specimen), 14.0 mm.; tarsus, 25.0-26.0 mm.

**Upucerthia dumetaria dumetaria** Is. Geoff. Saint-Hilaire

*Upucerthia dumetaria* Is. Geoff. Saint-Hilaire, Nouv. Ann. Mus. Hist. Nat. (Paris), 1, 1832, p. 394. (Patagonia.)

43,004, Loma Partida, Río Negro, June 18, 1911, male.

43,005, Arroyo Seco, Río Negro, September 7, 1911, female.

43,006, Arroyo Cumallo, Río Negro, January 28, 1912, male juvenile.

These birds are probably representative of the typical subspecies of *dumetaria*. The immature specimen, which is in juvenal dress, is slightly more olive above than adults, and has the hind neck obscurely streaked and spotted with dull buff. The underparts are whiter and have more distinct dark squamations on the feathers and the abdomen mottled with dusky. The adults measure as follows: Male: Wing, 102.6 mm.; tail, 86.0 mm.; culmen from base, 36.9 mm.; tarsus, 26.5 mm. Female: Wing, 102.8 mm.; tail, 82.2 mm.; culmen from base, 35.5 mm.; tarsus, 27.0 mm.

**Cinclodes fuscus fuscus** (Vieillot)

*Anthus fuscus* Vieillot, Nouv. Diet. Hist. Nat., 26, 1818, p. 490. (Montevideo and Buenos Aires.)

43,010-43,011, Lago Fétalaufquen, Chubut, March 3, 1913, male and female.

These two specimens average darker above and below, and have slenderer bills than the majority of specimens of *C. f. fuscus* examined. As the series at hand is made up almost entirely of winter migrants, it is not practicable to study the variation of the race known as *fuscus*, a matter that may be undertaken successfully only with specimens secured on the breeding grounds.

**Cinclodes patagonicus rupestris** (Kittlitz)

*Opetiorynchus rupestris* Kittlitz, Mem. Acad. Imp. Sci. St.-Petersbourg Div. Sav., 1, 1831, p. 188. (Chile.)

43,007-43,008, Huanuluan, Río Negro, December 7, 1911, male and female.

43,009, Lago Fétalaufquen, Chubut, March 3, 1913, immature female.

The two taken at Huanuluan are marked as accompanied with a set of eggs. The immature bird is slightly grayer than adults above and below. Hellmayr (1914, pp. 175-176) has noted that *Cinclodes molitor* of Scott (1900, p. 62) is a synonym of *Opetiorynchus rupestris* of Kittlitz, and that the bird should stand as a subspecies of *C. patagonicus*. The localities given above are additional to those cited by Dabbene (1919, pp. 181-182) in his revision of the Argentine forms of the genus *Cinclodes*.



***Enicornis phoenicurus* (Gould)**

*Eremobius phoenicurus* Gould, Zool. Voy. Beagle, pt. 3, Birds, Nov., 1839, p. 69, pl. 21. (Port Desire, St. Julian and Santa Cruz, Patagonia.)  
43,023, San Antonio Oeste, Río Negro, December 22, 1913, female juvenile.  
43,022, Paja Alta, Río Negro, June 4, 1911, male.

The immature specimen is slightly more buffy above than the adult, and has the lower surface less distinctly streaked. Both of these birds differ from Gould's original plate of the species in having the median pair of rectrices without rufous and the breast grayish with distinct white streaks.

If it is considered that *Eremobius* Gould, 1839, is preoccupied by *Eremobia* Stephens, 1829 (for a group of Lepidoptera), then the present genus must be known as *Enicornis* Gray (1840, p. 17), emended by Sclater to *Henicornis*.

The bird described by Scott (1900, p. 63) as *Henicornis wallisi* from Arroyo Eke, Patagonia, is said to have a longer bill and shorter wing than Gould's *Eremobius phoenicurus*, and the median rectrices without rufous. As it comes from Santa Cruz, only a short distance from the coast, it seems doubtful that it is different from *phoenicurus*, a point to be settled when types of the two forms can be compared. Salvadori (1908, p. 453) says that, according to Hellmayr, the differences outlined by Scott fail to hold and that skins seen in the Tring Museum that may be this form differ from Gould's types in the British Museum only in lack or restriction of ferruginous at the base of the middle rectrices. Peters (1923, p. 314) has used the name *wallisi* for specimens from west central Río Negro, but expresses doubt as to the validity of the form.

The type specimen of *Enicornis striata* Allen (1889, p. 89), which I have examined in the American Museum of Natural History, proves to be *Upucerthia ruficauda* and so has no connection with the present species.

The immature bird secured by Pemberton has a distinct wash of cinnamon on the webs of the central tail feathers, the two adults a slighter indication of the same color. These are closely similar to the birds mentioned by Peters secured above, and to one that I took near Zapala in Neuquen. Under these circumstances it appears doubtful that coast and interior birds in Santa Cruz differ from one another as Scott has endeavored to hold.

**Aphrastura spinicauda** (Gmelin)

*Motacilla spinicauda* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 978. (Tierra del Fuego.)

43,041-43,043, Bariloche, Río Negro, February 24 and 29, 1912, adult and immature male, immature female.

The immature birds have the tails not quite grown.

**Sylviorthorhynchus desmursii** Gay

*Sylviorthorhynchus desmursii* Gay, Hist. Fis. Pol. Chile, Zool., 1, 1847, p. 316. (Corral, Valdivia, Chile.)

43,033, Lago Fetalaufquen, Chubut, March 4, 1913, immature female.

This constitutes a new record of occurrence for the species.

There is some confusion as to the place of original description since it is found in Gay as indicated above, with a reference to "*S. Desmursii* Cl. Gay, Icon.," and in Desmurs' *Iconographie Ornithologique*, where it was printed in *Livraison 8* (published early in 1847) with a reference to Gay's work on Chile. Though Desmurs was author of the text on birds in both works, apparently the intention is to credit Gay with the present species. Desmurs' plate in the *Iconographie* is lettered *S. maluroides*.

**Phleocryptes melanops melanops** (Vieillot)

*Sylvia melanops* Vieillot, Nouv. Dict. Hist. Nat., 11, 1817, p. 232. (Paraguay.)

43,040, Río Fetalaufquen, Chubut, February 4, 1913, male.

The present specimen, an immature bird in full fall plumage, does not differ from available skins from Buenos Aires and Uruguay.

**Leptasthenura aegithaloides pallida** Dabbene

*Leptasthenura aegithaloides pallida* Dabbene, El Hornero, 2, no. 2, January, 1921, p. 135. (Puesto Burro, Maitén, Chubut, altitude 700 meters.)

43,025-43,026, Paja Alta, Río Negro, June 4, 1911, males.

These specimens, in full, heavy winter plumage, show very clearly the character of pale coloration that serves to distinguish the recently described subspecies *pallida* from typical *aegithaloides* of Chile. Following are measurements of these two birds: Wing, 64.4-66.0 mm.; tail, 92.5-102.6 mm.; culmen from base, 8.7-10.0 mm.; and tarsus, 17.8-18.5 mm.

***Siptornis sordida sordida* (Lesson)**

*Synallaxis sordidus* Lesson, Rev. Zool., 1839, p. 104. (Chile.)

43,018, Río Fetalefufu, Chubut, February 4, 1913, male.

43,019, Lago Fetaaufquen, Chubut, March 3, 1913, female.

These two birds, both in barred juvenal plumage, with only a faint yellowish wash to indicate the throat patch, are somewhat brighter, more buffy brown than comparable skins of *S. s. flavogularis* (Gould) from the Province of Mendoza, Argentina, and on this basis are placed with typical *sordida*. Material representing *sordida* of similar age from Chile is lacking. It is possible that these are intermediate specimens, since skins that I have seen from northern Río Negro and Neuquen are closely similar to *flavogularis* from near Bahia Blanca.

***Siptornis modesta* (Eyton)**

*Synallaxis modestus* Eyton, Jardine's Contr. Ornith., 1851 (published 1852), p. 159. ("Bolivia?"). Berlepsch, Jour. für Ornith., 1901, pp. 94-95, considers that Chilean birds represent the typical form.)

43,012, Paja Alta, Río Negro, June 4, 1911, female.

43,013, Arroyo Seco, Río Negro, August 21, 1911, female.

43,014, Arroyo Anecon Grande, Río Negro, December 24, 1911, female.

None of these three has more than a faint indication of a rufous throat patch. *S. modesta* is readily distinguished from *S. sordida* by the bicolored rectrices (all of the feathers being partly blackish and partly brown) and by the indistinct whitish striations on the breast. The two species are confused because of the rather loose way in which they are described and differentiated in the British Museum catalogue. Several subspecies of this bird have been described, but in absence of specimens of the species other than the three listed above I am unable to state to what form these belong.

*S. modesta* is stated to be of widespread range in Argentina, but must be rarer than one would suppose from published statements, since I failed to secure it there during extended field work in 1920 and 1921.

***Siptornis patagonica* (d'Orbigny)**

*Synallaxis patagonica* d'Orbigny, Voy. Am. Merid., Ois., 1835-1844, p. 249. (Río Negro.)

43,020-43,021, San Antonio Oeste, Río Negro, December 21, 1913, two males.

These two specimens, in somewhat worn plumage, are from near the locality where the types were taken by d'Orbigny.

***Siptornis anthoïdes* (King)**

*Synallaxis anthoïdes* King, Proc. Comm. Sci. Corr. Zool. Soc. London, March 2, 1831, p. 30. (Straits of Magellan.)

43,015-43,017, Bariloche, Río Negro, March 8, 1912, two immature males, one adult female.

These three specimens are more buffy below than a single skin examined from Laredo Bay in the Straits of Magellan, but as the latter is in juvenal plumage, it is not strictly comparable. The present species appears specifically distinct from *Siptornis hudsoni* Sclater of central Argentina.

***Pseudoseisura gutturalis* (d'Orbigny and Lafresnaye)**

*Anabates gutturalis* d'Orbigny and Lafresnaye, Mag. Zool., 1838, cl. 2, p. 15. (Río Negro, Patagonia.)

42,995-42,996, Arroyo Las Bayas, Río Negro, May 25, 1912, male and female.

These birds, in full winter plumage, are much more heavily feathered than specimens taken in worn midsummer dress, but are otherwise similar save that the short crest is more obscured by the longer, fuller feathers below it.

***Pygarrhichas albo-gularis* (King)**

*Dendrocolaptes albo-gularis* King, Proc. Comm. Sci. Corr. Zool. Soc. London, March 2, 1831, p. 30. (Straits of Magellan.)

43,037, Bariloche, Río Negro, February 26, 1912, male.

43,038, Upper Arroyo Las Bayas, Río Negro, June 3, 1912, female.

43,039, Río Pico, Chubut, January 24, 1914, female.

The first and last of the skins listed are in immature dress, with streaked dorsal surface. The second is fully adult. No specimens have been examined from the Straits of Magellan in this connection, but the birds here discussed do not seem to differ from two from Valdivia, Chile.

Family RHINOCRYPTIDAE<sup>1</sup>**Scytalopus magellanicus** (Gmelin)

*Motacilla magellanica* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 979. (Tierra del Fuego.)

43,032, Bariloche, Río Negro; February 24, 1912, female.

The single specimen, though fully grown, apparently is immature. It is slightly lighter in color than specimens in the National Museum from the vicinity of the Straits of Magellan, but is darker than others from near Valdivia, Chile. It is possible that *magellanicus* in the regions mentioned may, with sufficient material, be separated into two geographical races.

**Teledromas fuscus** (Selater and Salvin)<sup>2</sup>

*Rhinocrypta fusca* Selater and Salvin, Nom. Av. Neotr., 1873, p. 161. (Mendoza.)

43,024, Nahuel Niyeu, Río Negro, July 5, 1911, male.

The single specimen taken is very slightly brighter than skins examined from General Roca, Río Negro, a condition due without doubt to the fact that it is in fresh plumage, while the others were secured in midsummer. The feathers are remarkably lax and full, the condition suggesting that found in jays, tits, and others taken in the dead of winter in cold countries.

Measurements of this specimen are as follows: Wing, 77.3 mm.; tail, 69.2 mm.; exposed culmen, 12.6 mm.; tarsus, 32.7 mm.

**Scelorchilus rubecula** (Kittlitz)

*Pteroptochos rubecula* Kittlitz, Mem. Acad. Imp. Scienc. St.-Petersbourg Div. Sav., 1, 1830, p. 179, pl. 2. (Concepción, Chile.)

43,044, Bariloche, Río Negro, February 29, 1912, female.

43,045, Lago Fetalauquen, Chubut, February 12, 1913, male.

43,046-43,047, ~~El~~ Pico, Chubut, January 24, 1914, male and female.

Oberholser (1923, pp. 326-327) has indicated that *Pteroptochos* Kittlitz is a synonym of *Hylactes* King, and has renamed the group of small tapaculos *Scelorchilus* with *Pteroptochos rubecula* Kittlitz as type.

<sup>1</sup> If it is considered that the first group name selected designates the type for a family, the tapaculos must be known as the Rhinocryptidae, since d'Orbigny (1839, p. 192) used for the species that he treated the group name Rhinomidae, taken from *Rhinomya*, which is a synonym of *Rhinocrypta*.

<sup>2</sup> For use of the generic term *Teledromas*, see Wetmore and Peters (1922, p. 41).

The series of specimens secured by Pemberton is fairly uniform in coloration.

Study of specimens in the U. S. National Museum and the Harvard Museum of Comparative Zoölogy has seemed to indicate three well marked forms of this species, but receipt of an excellent series of fresh material from Chile, collected for the Field Museum of Natural History, which I have examined through the kindness of Dr. Hellmayr, apparently shows that the species does not vary notably throughout its range. The subspecies *hylonympha* and *nemorivaga* described respectively by J. L. Peters and myself appear to have been based on postmortem changes in coloration and so must stand as synonyms of *rubecula*. Skins from Bariloche and western Chubut are very faintly darker above especially on the crown, and are somewhat darker on the flanks, than a series from the provinces of Valdivia and Malleco, Chile. A large series from Chiloë Island is also very faintly darker than skins from central Chile. The distinctions are so weak that at present it is deemed best not to recognize them by name.

### ***Pteroptochos tarnii tarnii* (King)<sup>1</sup>**

*Hylactes tarnii* King, Proc. Comm. Sci. Corr. Zool. Soc. London, pt. 1,

January 6, 1831, p. 15. (Port Otway, Straits of Magellan.)

43,048, Bariloche, Río Negro, February 24, 1912, male.

43,050, Lago Mosquitos, Cholila, Chubut, March 19, 1913, female.

43,049, Río Fataleufu, Chubut, February 4, 1913, male.

The specimens taken February 4 and March 19 are molting on the fore part of the body and head.

The small series listed above agrees in general with two skins in the U. S. National Museum from Port Otway in the Straits of Magellan, but in common with two others from Nahuel Huapí (purchased for the Biological Survey, from the collector E. Budin) averages almost imperceptibly paler. Two skins in the National Museum from Valdivia, Chile, have the back, breast, and foreneck distinctly lighter and browner than others, and may be distinguished as *Pteroptochos tarnii ruficeps* (d'Orbigny and Lafresnaye). As in the original description King gives the habitat of *Hylactes tarnii* as Chiloë Island and Port Otway, I hereby restrict the type locality of *Pteroptochos tarnii tarnii* to Port Otway, Straits of Magellan.

<sup>1</sup>For use of the generic name *Pteroptochos* in this connection, see Hellmayr (1924, p. 3).

## Family TYRANNIDAE

***Agriornis striata striata* Gould**

*Agriornis striatus* Gould, Zool. Voy. Beagle, pt. 3, Birds, July, 1839, p. 56.  
(Santa Cruz, Argentina.)  
42,967-42,969, Cabeza de Vaca, Río Negro, September 15, 1911, male and two females.

These specimens, in full plumage, are similar to others examined from General Roca, Río Negro, Zapala, Neuquen, and the Province of Mendoza. Females differ from males only in that the two outermost primaries are normal, instead of being abruptly narrowed at the tip.

***Agriornis montana* (d'Orbigny and Lafresnaye)**

*Pepoaza montana* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 64.  
(Chuquisaca, Bolivia.)  
42,970, Cerro Aspero, Río Negro, December 17, 1911, female.  
42,971, Lago del Condor, Cholila, Chubut, March 19, 1913, young male.

The immature bird, in juvenal plumage, is much darker in color than the adult, both above and below, and has the abdomen and under-tail coverts washed with buff. The tail is white as in older plumages, while the ninth and tenth primaries are normal as in females, not conspicuously narrowed as in old males. The female is in worn breeding plumage.

*Agriornis leucurus* Gould (1839, pl. 13) is based on the immature plumage of this species from the coast of Patagonia, and agrees closely with the specimen from Lago del Condor. The female listed above is slightly darker than three seen from Chile, and probably differs subspecifically from typical *montana*. With a larger series it may be possible to recognize *leucura* of Gould as a valid subspecies for birds of this species from Patagonia. *Agriornis poliosoma* Scott (1900, p. 55) from the Arroyo Gio, Santa Cruz, from the description will probably appear as a synonym of *leucura*.

Peters (1923, p. 319) has listed skins from Huanuluan as *leucura* without comment.

**Myiotheretes rufiventris** (Vieillot)

*Tyrannus rufiventris* Vieillot, Tabl. Enc. Meth. Ornith., 2, 1823, p. 856.  
(Montevideo, Uruguay.)

42,972-42,973, Arroyo Seco, Río Negro, September 2 and 6, 1911, males.  
42,974, Cerro Anecon Grande, Río Negro, January 16, 1911, male.

The January specimen is much worn.

**Taenioptera pyrope ignea** Wetmore

*Taenioptera pyrope ignea* Wetmore, Univ. Calif. Publ. Zool., 21, June 16, 1923, p. 334. (Laredo Bay, Straits of Magellan.)

42,978-42,979, Bariloche, Río Negro, February 22 and 24, 1912, juvenile male and female.

42,980-42,981, Río Fataleufu, Chubut, February 3, 1913, immature males.

These specimens are paler above than typical *T. p. ignea* from the Straits of Magellan, but are nearer to that form than to true *pyrope* of central Chile. They probably mark the northern limit of the southern form. One of the young from Bariloche has molted into first fall dress. The female, still in juvenal plumage, is hair brown above and on the sides, and has the gray of the breast indistinctly and indefinitely streaked with whitish. None of the males shows the deeply excised outer primaries found in adults after the first complete wing molt.

**Taenioptera murina** (d'Orbigny and Lafresnaye)

*Pepoaza murina* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 63.  
(Río Negro, Argentina.)

42,975, Cabeza de Vaca, Río Negro, September 18, 1911, male.

42,976-42,977, San Antonio Oeste, Río Negro, December 21, 1913, adult and immature male.

The immature bird, which is fully grown but is in juvenal plumage, is tinged faintly with ochraceous above and below, has the throat streaks brownish in color and nearly obsolete, and the breast faintly mottled with grayish. Four outer primaries are faintly sinuate on the inner margin as in the adult, but the two outer primaries are normal as in females, not deeply incised and attenuate as in adult males.



**Taenioptera rubetra** Burmeister

*Taenioptera rubetra* Burmeister, Jour. für Ornith., 1860, p. 247. (Sierra de Mendoza.)

42,988, San Antonio Oeste, Río Negro, December 21, 1913, female adult.

42,986-42,987, Arroyo Seco, Río Negro, September 6 and 8, 1911, two males.

The three specimens taken are all in full breeding plumage. The male in this species is somewhat less heavily streaked on the breast and is more rufescent above than the female. The two outermost rectrices, though normal in the female, are distinctly attenuated at the tips in the male.

**Lichenops perspicillata andina** Ridgway

*Lichenops perspicillatus andinus* Ridgway, Proc. U. S. Nat. Mus., 2, May 22, 1879, p. 483. (Santiago, Chile.)

42,993-42,994, Corral Chico, Río Negro, September 25, 1911, adult males.

42,989-42,992, Arroyo Cumallo, Río Negro, January 28, 1912, three young males, one young female.

The adult males have the white of the wing somewhat less obscured by black than usual in typical *andina*, but are nearer that form than to *perspicillata*; the black markings on the outer webs of the primaries are broad and extend far beyond the coverts. One specimen differs from any other seen in that the forehead at the base of the bill is white, this color extending to the feathers of the nasal fossae. Two of the young from the Arroyo Cumallo are in worn plumage, but have not yet begun to molt. The adult males have a wing measurement of 90.1 and 93.2 mm., respectively.

**Muscisaxicola hatcheri** Scott

*Muscisaxicola hatcheri* Scott, Bull. Brit. Orn. Club, 10, March 31, 1900, p. 55. (Cordillera, Upper Río Chico, Santa Cruz, Argentina.)

42,985, Lago Fetalaufquen, Chubut, March 3, 1913, male.

The present specimen agrees with Scott's brief diagnosis of *hatcheri* from the headwaters of the Río Chico and is identified, with some reservation, as that bird. It is an immature specimen but fully grown. Compared with a single skin of *Muscisaxicola grisea* Taczanowski (1884, p. 213) from Ollantaytambo, Peru, the skin from Lago Fetalaufquen is distinctly more brownish above, and has the light

breast indistinctly mottled with gray to produce an almost imperceptible, irregular streaking of light and dark. The forehead is whitish save for a narrow space at the base of the culmen, while the superciliary is indistinct behind the eye. The greater and middle wing coverts are tipped indistinctly with dull buff to form two poorly differentiated bands, with further irregular buff edgings on the lesser coverts. The inner primaries and secondaries are tipped distinctly with whitish, all of these wing markings probably being marks of first winter plumage. The skin has the following measurements: Wing, 132.0 mm.; tail, 73.5 mm.; culmen from base, 17.0 mm.; tarsus, 31.8 mm.

***Muscisaxicola frontalis* (Burmeister)**

*Ptyonura frontalis* Burmeister, Jour. für Ornith., 1860, p. 248. (Base of the Sierra Mendoza, Argentina.)

42,982, Anecon Grande, Río Negro, January 16, 1912, immature male.

The present specimen though immature is fully grown; it has dull buff tips on the wing coverts that form two indistinct wing bands, while the black of the head is somewhat suffused. The distinctions between *frontalis* of Argentina and its supposed subspecies *nigrifrons* Philippi and Landbeck (1864, p. 436) of Chile is somewhat uncertain. Three skins from Chile (two from near Santiago) resemble the skin from Río Negro but are somewhat duller colored above. No typical specimens of *frontalis* are at hand. As the skin from Anecon Grande is that of an immature bird it is hardly comparable with the three adults supposed to represent *nigrifrons*, so that it is not identified subspecifically. The measurements are as follows: Wing, 119.5 mm.; tail, 74.3 mm.; culmen from base, 21.0 mm.; tarsus, 33.0 mm.

***Muscisaxicola macloviana mentalis* d'Orbigny and Lafresnaye**

*Muscisaxicola mentalis* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 66. (Cobija, Bolivia, Arica, and Patagonia.)

42,960-42,961, Nahuel Niyeu, Río Negro, July 6, 1911, males.

42,962, Arroyo Seco, Río Negro, September 7, 1911, male.

42,963-42,965, Lago Fetalauquen, Chubut, March 3 and 4, 1913, two males and immature female.

The immature bird recorded, save for larger size, is reminiscent of *M. maculirostris*, since it has the same cinnamon wash on wings and back, and lacks entirely the dark markings found on the head in adults. The bird though in full juvenal plumage is not entirely grown. The present specimens are allocated under the subspecies

*mentalis* without comparison with typical *macloviana* from the Falkland Islands, as recent authors have considered the two distinct.

Skins from Chile seem slightly paler above than those listed here, as well as from others seen from the vicinity of the Straits of Magellan (January and February) and Puesto Burro, Maitén, Chubut (April 19, 1918).

### ***Muscisaxicola flavinucha* Lafresnaye**

*Muscisaxicola flavinucha* Lafresnaye, Rev. Mag. Zool., 1855, p. 59. (Chile.)  
42,963-42,984, Anecon Grande, Río Negro, January 16, 1912, males.

These two appear slightly darker and grayer above and below, and have the flanks paler than a series of five examined from Chile. The latter, however, were prepared many years ago and may have changed in color with age. The species has been recorded from the Cumbres Calchaquies, Tucumán, at an altitude of 4500 meters, and from Santa Catalina, Jujuy (Dabbene, 1910, p. 321), but the two specimens listed above appear to constitute the only records for Patagonia.

### ***Muscisaxicola capistrata* (Burmeister)**

*Ptyonura capistrata* Burmeister, Jour. für Ornith., 1860, p. 248. (Base of Sierra de Uspallata, Mendoza.)  
42,966, Corral Chico, Río Negro, September 25, 1911, female.

The single specimen is in breeding plumage. The present species, which is not included in the Catalogue of Birds in the British Museum, was described by W. E. D. Scott (1900, p. 55) from Coy Inlet, Santa Cruz, as *Muscisaxicola garretti*. The bird from Corral Chico does not appear to differ from three skins in the U. S. National Museum from Mendoza, while these in turn resemble one from Puesto Burro, Maitén, Chubut, secured in April, 1918, and four from near Coy Inlet, Santa Cruz (see also Schalow, 1900, p. 97). The species as yet appears to be rare in collections.

### ***Muscisaxicola maculirostris* d'Orbigny and Lafresnaye**

*Muscisaxicola maculirostris* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 66. (La Paz, Bolivia.)  
42,958, Corral Chico, Río Negro, October 15, 1911, female.  
42,959, Cerro Anecon Grande, Río Negro, January 17, 1912, female.

These two specimens are in normal spring and summer plumage.

***Lessonia rufa rufa* (Gmelin)**

*Alauda rufa* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 792. (Buenos Aires.)  
43,030-43,031, Corral Chico, Río Negro, September 25, 1911, male and female.

In the male of the present species the seventh and tenth primaries are normal while the eighth and ninth are narrowed and slightly shortened so that they are concealed beneath the tenth. In the female the wing formula is 9, 8, 7, 10, and the eighth and ninth are normal. The elongated hind claw, like that of a pipit, is certain to attract attention in handling these birds in the flesh. The two listed above are in full breeding plumage.

***Myiosympotes flaviventris* (d'Orbigny and Lafresnaye)**

*Alecturus flaviventris* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 55. (Corrientes, Argentina.)  
43,056, Río Chubut, below Leleque, Chubut, January 1, 1914, adult male.

This specimen, in full plumage, has the following measurements: Wing, 50.4 mm.; tail, 54.0 mm.; culmen from base, 13.3 mm.; tarsus, 20.7 mm. Specimens from Patagonia, west Argentina (Mendoza), and Chile, average slightly larger than those from Buenos Aires north into Paraguay, and later may possibly warrant a subspecific designation when they will be known as *M. f. citreola* (Landbeck) described from the Valley of Mapocho above Santiago, Chile (Landbeck, 1864, p. 338).

***Spizitornis flavirostris flavirostris* (Selater and Salvin)**

*Anaeretes flavirostris* Selater and Salvin, Proc. Zool. Soc. London, 1876, p. 355. (Tilotilo, Yungas, Bolivia.)  
43,029, Arroyo Salado, Río Negro, July 16, 1911, male.

The present specimen marks the most southern point at which *A. flavirostris* is known. It is in winter plumage, and is grayer above and yellower below than birds taken in midsummer. The species is readily distinguished from any of the forms of *A. parulus* by the yellowish base of the lower mandible and the more heavily streaked underparts.

**Spizitornis parulus curatus** Wetmore and Peters

*Spizitornis parulus curatus* Wetmore and Peters, Auk, 1924, p. 145. (Río Colorado, Gobernación de Río Negro, Argentina.)  
43,027-43,028, Paja Alta, Río Negro, June 4, 1911, females.

These two specimens represent the southern limit from which I have seen skins of this subspecies though Durnford (1877, p. 34) has recorded the bird from Chubut. *S. p. curatus*, described from Río Colorado in eastern Río Negro, ranges north to Córdoba, and the eastern foothills of the Andes in Mendoza. It is distinguished from *S. p. patagonicus* Hellmayr, of northwestern Río Negro and eastern Neuquen, by the yellow abdomen and browner back, and from *S. p. parulus* by paler dorsal surface and distinct wing bars.

**Tachuris rubrigastra rubrigastra** (Vieillot)

*Sylvia rubrigastra* Vieillot, Nouv. Dict. Hist. Nat., 11, 1817, p. 277. (Paraguay and Buenos Aires.)  
43,055, Valcheta, Río Negro, October 4, 1911, male.

The present specimen, in fully adult plumage, is identical with skins from the Province of Buenos Aires. Measurements: Wing, 52.0 mm.; tail, 44.0 mm.; culmen from base, 10.9 mm.; tarsus, 20.5 mm. Durnford (1877, p. 34; 1878, p. 395) has recorded the species as common south to the Chubut and Sengel rivers in Chubut.

**Elaenia albiceps albiceps** (d'Orbigny and Lafresnaye)

*Muscipeta albiceps* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 47. (Yungas, Bolivia.)  
43,057-43,058, Bariloche, Río Negro, February 24, 1912, adult male and juvenile female.  
43,059, Río Pico, Chubut, January 27, 1914, male.

The immature bird is not quite fully grown.

The type locality for this form has been restricted to Yungas by Berlepsch (1907, p. 403).

## Family PHYTOTOMIDAE

**Phytotoma rara** Molina

*Phytotoma rara* Molina; Sagg. Stor. Nat. Chili, 1782, p. 254. (Chile.)  
42,924-42,925, Bariloche, Río Negro, February 24 and 25, 1912, male and female.

These two specimens seem a trifle smaller than a small series from near Santiago, Chile, but are otherwise similar. The wing in the male measures 88.0 mm., and in the female 87.8 mm. Both specimens are in worn breeding plumage. The iris in the male is recorded as red orange.

## Family HIRUNDINIDAE

*Iridoprocne meyeri* (Cabanis)

*Petrochelidon meyeri* Cabanis, Mus. Hein., pt. 1, 1850, p. 48. (Santiago, Chile.)

42,895, Río Fataleufu, Chubut, February 3, 1913, adult female.

42,896, Río Pico, Chubut, January 19, 1914, immature female.

These specimens seem faintly darker than skins from central Chile, but are similar to them in size. Specimens in the U. S. National Museum from the Straits of Magellan have slightly longer wings than those from the type locality. Though Sharpe (1885, p. 117) remarks that in the young of this species the white supraloral streak is more distinct than in the adult, I find it barely perceptible in two juvenile birds (including one taken personally at Guaminí, Buenos Aires, and the one listed above).

*Pygochelidon patagonica patagonica* (d'Orbigny and Lafresnaye)

*Hirundo patagonica* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 69. (Patagonia.)

43,897-43,898, Cerro Anecon Grande, Río Negro, January 7, 1912, males.

42,899, Arroyo Cumallo, Río Negro, January 28, 1912, immature male.

42,900, Río Pico, Chubut, January 19, 1914, female.

In a small series of this swallow there is no notable variation in skins from Buenos Aires south to the Straits of Magellan.

*Progne elegans* Baird

*Progne elegans* Baird, Rev. Am. Birds, May, 1865, p. 275. (Vermejo River, Argentina.)

42,894, Corral Chico, Río Negro, October 15, 1911, male.

This specimen must record an early migrant of the species at this southern locality.

P. L. Selater (Selater and Hudson, 1888, p. 24) has doubted the occurrence of this species in Chile, but Edwyn C. Reed (1896, p. 199) records that he collected several specimens at Paine, in the Province of O'Higgins.

Mr. Todd has called attention to the fact that *Progne elegans* Baird is the same as *P. furcata* Baird, the name in common use for this martin, and must replace it, as, though both are described in the same work, *elegans* is given first.

## Family TROGLODYTIDAE

**Troglodytes musculus magellanicus** Gould<sup>1</sup>

*Troglodytes magellanicus* Gould, Proc. Zool. Soc. London, February 20, 1837, p. 88. (Straits of Magellan.)

43,034, Arroyo Salado, Río Negro, July 16, 1911, male.

This specimen, in somewhat worn and abraded plumage, is similar in coloration of tail and back to a small series from the Straits of Magellan, and to some migrant house wrens found in winter in Buenos Aires. It is distinctly different from a good series from Chile and Mendoza that represent the Chilean form. Identification is made in accordance with Hellmayr's arrangement of the subspecies of *T. musculus* (1921, pp. 275-276). I believe that the statement (*loc. cit.*, p. 276) regarding the differences between *chilensis* and *magellanicus* has been reversed through some slip, and that the characters outlined of more brownish back, more rufous rump, rectrices, etc., are intended to apply to *magellanicus* and not to *chilensis* as stated.

**Troglodytes musculus chilensis** Lesson

*Troglodytes chilensis* Lesson, Voy. Coquille, Zool., 1, pt. 2, April, 1830, p. 665. (Concepción, Chile.)

43,035, Lago Fetalauquén, Chubut, March 3, 1913, female.

This specimen has the pale coloration characteristic of the Chilean bird. Like the skin of *T. m. magellanicus* it is identified in accordance with Hellmayr's arrangement (1921, pp. 275-276). (See also Chapman and Griscom, 1924, p. 299.)

**Cistothorus platensis hornensis** (Lesson)

*Troglodytes hornensis* Lesson, L'Institut, No. 72, September 27, 1834, p. 316. (On ship board at sea twenty leagues southeast of Cape Horn.)

43,036, Arroyo Las Bayas, Río Negro, May 27, 1912, male.

This bird, in bright plumage, agrees with skins seen from Chile and the Straits of Magellan. As *C. p. platensis* is recorded from Bahía Blanca, Las Bayas must be near the northern limit for *hornensis*.

Hellmayr (1921, p. 252) has shown that *Troglodytes hornensis* Lesson, usually referred to the Patagonian house wren, in reality relates to *Cistothorus*.

<sup>1</sup> For a statement regarding this form see a recent paper by Chapman and Griscom, (1924, pp. 301-302).

## Family MIMIDAE

**Mimus patagonicus patagonicus** (d'Orbigny and Lafresnaye)

*Orpheus patagonicus* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 19. (Patagonia.)

43,053-43,054, San Antonio Oeste, Río Negro, December 22, 1913, adult male, juvenile female.

43,051-43,052, Paja Alta, Río Negro, June 4, 1911, females.

The specimen in juvenal plumage from San Antonio is not quite fully grown. It has the dull grayish-brown upper breast streaked obscurely with whitish, but is otherwise similar to adults, though duller. June specimens, in full winter plumage, are richer in color than the December male, which is in worn breeding plumage.

## Family TURDIDAE

**Turdus magellanicus pembertoni** Wetmore

*Turdus magellanicus pembertoni* Wetmore, Univ. Calif. Publ. Zool., 21, no. 12, June 16, 1923, p. 335. (Cerro Anecon Grande, Río Negro, Argentina.)

43,065-43,069, Cerro Anecon Grande, Río Negro, January 7, 1912, adult and two juvenile males, two adult females.

The present form, apparently one inhabiting the eastern, less elevated portion of northern Patagonia, where it is recorded only from Río Negro, is distinguished from *T. m. magellanicus* of the Straits of Magellan by much paler coloration. The type of the form is one of the adult females (M. V. Z. no. 43,065). Birds seen from Lake Nahuel Huapí agree in color with the southern subspecies. The paler, less buffy coloration that distinguishes this form holds for skins in juvenal plumage, as is shown when the two spotted young in the present collection are compared with birds in similar state of plumage in the U. S. National Museum, from Tierra del Fuego and the Straits of Magellan. One of the young taken by Pemberton is fully grown, the other is only recently from the nest.



## Family MÓTACILLIDAE

**Anthus correndera correndera** Vieillot

*Anthus correndera* Vieillot, Nouv. Dict. Hist. Nat., 26, 1818, p. 491.  
(Paraguay and Río de la Plata.)

43,060-43,061, Paja Alta, Río Negro, January 4, 1911, male and female.

These two birds, both fully adult, indicate a slight tendency toward *A. c. chilensis* in the yellowish cast of the dorsal surface and breast. (See fig. B.)

**Anthus correndera chilensis** (Lesson)

*Corydalla chilensis* Lesson, Rev. Zool., 2, 1839, p. 101. (Chile.)

43,062-43,064, Lago San Martín, Santa Cruz, December 11, 1914, one male, two females.

One of these specimens agrees in buffy coloration with skins from central Chile and the Straits of Magellan, a second is less yellowish, while the third might pass for *correndera*. The three show evident intergradation between *chilensis* and the typical form, but seem best allocated under the subspecies of western and southern distribution. All are in a good state of breeding plumage.

## Family ICTERIDAE

**Trupialis militaris militaris** (Linnaeus)

*Sturnus militaris* Linnaeus, Mant. Plant., app. 1771, p. 527. ("Terra Magellanica.")

42,901, Valcheta, Río Negro, May 25, 1911, male.

42,902, Paja Alta, Río Negro, June 7, 1911, male.

42,903, Nahuel Niyeu, Río Negro, July 6, 1911, female.

42,904, Arroyo Cumallo, Río Negro, January 28, 1912, juvenile male.

Adults taken are in full winter plumage. The immature bird is in juvenal dress, with merely a wash of red on the median line of the breast. Wing measurements of the two males (124.0 and 122.2 mm.) and of the female (116.0 mm.) are slightly less than in *militaris* from southern Patagonia, where the wing in males (Gregory and Laredo Bay, Straits of Magellan, and Río Gallegos, Santa Cruz), ranges from 128.5 to 139.1 mm.

**Notiopsar curaeus (Molina)**

*Turdus curaeus* Molina, Sagg. Stor. Nat. Chili, 1782, p. 252. (Chile.)

42,905-42,906, Río Corcovado, Chubut, January 12, 1913, male and female.

The female is in worn plumage while the male has begun to molt. Specimens from western Patagonia have slightly longer bills than those from central Chile. For use of the generic term *Notiopsar* see Oberholser (1921, p. 136).

**Agelaius thilius thilius (Molina)**

*Turdus thilius* Molina, Sagg. Stor. Nat. Chili, 1782, p. 250. (Chile.)

43,088, Río Fataleufu, Chubut, February 4, 1913 [female].

42,909-42,910, Lago Mosquitos, Cholila, Chubut, March 18, 1913, females.

These three specimens, all from the Andean region, agree in measurements (wing, 80.5, 82.0, and 86.0 mm.) with a series of the typical form from Chile. The first two appear to be small, but the measurements given do not represent the proper size, since in these individuals the wing quills are not quite grown after molt.

**Agelaius thilius chrysopterus Vieillot**

*Agelaius chrysopterus* Vieillot, Nouv. Dict. Hist. Nat., 34, 1819, p. 539. (Paraguay.)

42,907-42,908, Arroyo Seco, Río Negro, August 17 and 18, 1911, males.

These two, with wing measurements of 89.3 and 90.0 mm. respectively, while a trifle larger than usual in *chrysopterus* (eleven males from Buenos Aires and Santa Fé have the wing from 81.5 to 88.5 mm., average 85.1 mm.) seem as near that form as to true *thilius*, in which the wing ranges from 92.0 to 95.5, average 94.0 mm. (specimens from Chile and Peru). The two skins listed are nearly in breeding plumage.

**Molothrus bonariensis bonariensis (Gmelin)**

*Tanagra bonariensis* Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 898. (Buenos Aires.)

43,085-43,087, Valcheta, Río Negro, June 9 and October 5, 1911, two adult males, adult female.

One of the males taken (no. 43,086) has the bill so shortened and thickened, apparently through some slight deformity, as to suggest *Molothrus brevirostris*. The specimen, however, has the coloration and the longer tarsus found in *bonariensis*.

## Family FRINGILLIDAE

***Sicalis arvensis arvensis* (Kittlitz)**

*Fringilla arvensis* Kittlitz, Mem. Acad. Imp. Sci. Saint-Petersbourg Div Sav., 2, 1835, p. 470, pl. 4. (Valley of Quillota, Chile.)  
42,957, Bariloche, Río Negro, February 29, 1912, female.

The specimen is an adult in worn breeding plumage.

***Sicalis lebruni* (Oustalet)**

*Pseudochloris lebruni* Oustalet, Miss. Sci. Cap Horn 1882-1883, 6, 1891, Ois., p. 88. ("Missioneros, Patagonie.")  
42,951-42,953, Arroyo Las Bayas, Río Negro, May 24, 1912, two males, one female.  
42,949-42,950, Lago Carilaufquen, Río Negro, November 14, 1911, male and female.

The present species has been recorded at comparatively few localities since its description in 1891. There are a number in the U. S. National Museum collections taken on the Río Gallegos and at Coy Inlet, Santa Cruz, and Peters has recorded it from Maquinchao and Huanuluan in western Río Negro. The validity of the species has been questioned by Dabbene, but there is no doubt that it is distinct from others that have been named. The male has the head, wing coverts, rump, and lower surface washed with yellow. In the female there is a faint wash of this color on the lower breast alone. The species is distinguished from other members of the genus found in Argentina by the decided grayish wash of wings, back and tail, with yellow occurring only as indicated above.

*Pseudosicalis* of Chubb has been considered by Todd (1922, p. 519) as not separable from *Sicalis*, a decision that I have confirmed by careful examination of the majority of the species concerned.

***Phrygilus patagonicus* Lowe<sup>1</sup>**

*Phrygilus gayi patagonicus* Lowe, Ibis, 1923, p. 515. (Tierra del Fuego.)  
42,921, Bariloche, Río Negro, February 27, 1912, male.  
42,922-42,923, Río Corcovado, Chubut, January 12, 1913, male and female.

The two species of yellow and gray finches of this group have been in much confusion. In the original description of *Fringilla gayi* (see *postea*) Eydoux and Gervais state "le bas du ventre est d'un jaune clair;" and the plate is so colored, which would indicate that this name should apply to the smaller species, as the larger bird has the abdomen white and the yellow on the sides not extended as far back

toward the tail. On this basis, Mr. Peters and I had identified the smaller bird as *gayi* and the larger one as *aldunatei*. Dr. Hellmayr, however, affirms in correspondence, from his examination of specimens, abroad, that the reverse is true, and that the bird here treated should be called *patagonicus* of Lowe. Though not fully convinced of this, I have followed his determination.

The specimens of *patagonicus* in the Pemberton collection are fully adult.

### ***Phrygilus gayi* (Eydoux and Gervais)**

*Fringilla gayi* Eydoux and Gervais, Mag. Zool., 1834, cl. 2, pl. 23, with unpagcd text. (Chile.)

42,917-42,919, Loma Partida, Río Negro, June 18, 1911, two males, one female.

42,920, Arroyo Salado, Río Negro, July 16, 1911, immature male.

P. R. Lowe (1923, p. 515) has described an eastern subspecies of this bird as *Phrygilus gayi koslowskii* (type locality, Valle del Lago Blanco, Chubut). With a series of *gayi* from Chile and Argentina (Mendoza south to Santa Cruz) before me I cannot separate two geographic races, though the material from Chile is not wholly satisfactory. Should it prove that Lowe's contention as to an eastern race is correct, it must be noted that *Phrygilus caniceps* Burmeister (1860, p. 256), named from Mendoza, from the original description, seems to be based on an immature of *P. gayi*, which will make this name available for an eastern form. The two adult males that I have seen from Mendoza are identical with others from Patagonia.

### ***Phrygilus fruticeti fruticeti* (Kittlitz)**

*Fringilla fruticeti* Kittlitz, Kupf. Naturg. Vög., 1833, p. 18, pl. 23, fig. 1. (Coast near Valparaíso, Chile.)

43,094, Nahuel Niyeu, Río Negro, July 6, 1911, immature male.

43,091-43,092, Paja Alta, Río Negro, June 7, 1911, immature males.

43,089-43,090, Arroyo Seco, Río Negro, August 11 and 13, 1911, immature male and female.

43,093, Arroyo Anecon Grande, Río Negro, December 26, 1911, adult female.

42,935, Arroyo Cumallo, Río Negro, February 2, 1912, adult male.

The two adults are in worn breeding plumage, the male being so worn that it is nearly solid black on the throat and chest and shows very little gray above. Immature males in first winter plumage are quite similar to females except that the throat patch is more prominent. There is no apparent difference between these skins and a small series from Chile.

***Phrygilus carbonarius* (d'Orbigny and Lafresnaye)**

*Emberiza carbonaria* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 79. (Patagonia.)

42,936, Nahuel Niyeu, Río Negro, July 5, 1911, male.

This is an immature bird in first winter plumage, with the black of the lower surface largely obscured by grayish and brownish tips to the feathers, and the back grayish brown streaked with fuscous as in the female.

***Phrygilus unicolor plumbeus* (Philippi and Landbeck)**

*Chlorospiza plumbea* Philippi and Landbeck, Anal. Univ. Chile, 24, April, 1864, p. 341. (Cordillera of Santiago and Colchagua, Chile, at 6000 to 8000 feet.)

42,932, Arroyo Cumallo, Río Negro, February 2, 1912, adult male.

42,939, Cerro Anecon Grande, Río Negro, January 7, 1912, adult female.

42,933-42,934, 42,940-42,941, Lago San Martín, Santa Cruz, December 10 and 13, 1914, two adult, one immature male, female.

Examination of a fair series of the present species indicates that it may be separated into six geographic races as follows:

**1. *Phrygilus unicolor unicolor* (d'Orbigny and Lafresnaye)**

*Emberiza unicolor* d'Orbigny and Lafresnaye, Mag. Zool., 1837, cl. 2, p. 79. (Cordillera de Tacora, Peru, Pampa de Oruro, Bolivia.)

Size small, coloration dark, male nearly uniform above and below. Wing in male (one specimen), 89.0 mm.; in female (one specimen), 81.0 mm.

Highlands of Peru (seen from Matchu Picchu), Bolivia ?

**2. *Phrygilus unicolor nivarius* (Bangs)**

*Haplospiza nivaria* Bangs, Proc. Biol. Soc. Washington, 13, 1899, p. 102. (Paramo de Chiriqua, 15,000 feet, Santa Marta, Colombia.)

Similar to *P. u. unicolor* (d'Orbigny and Lafresnaye) but paler and slightly smaller. Wing in male (one specimen), 81.8 mm.; in female (two specimens), 77.0-79.4 mm.

Higher Andes of Santa Marta, Colombia (Cerro de Caracas, Paramo de Mamarongo, and Paramo de Chiriqua.)

**3. *Phrygilus unicolor montosus* (Riley)**

*Haplospiza montosa* Riley, Proc. Biol. Soc. Washington, 18, 1905, p. 220. (San Antonio, Venezuela, 3000 meters altitude.)

Female similar to *P. u. nivarius* (Bangs) but much paler below, with broader dark streaks. Wing in male (type specimen), 80.7 mm.; in female (three specimens), 71.3-72.5 mm.

Chapman, in a review of the northern races of *Phrygilus unicolor* (1915, p. 653), has united *montosus* with *nivarius*, but I believe that they should be considered distinct.

4. *Phrygilus unicolor geospizopsis* (Bonaparte)

*Passerculus geospizopsis* Bonaparte, Compt. Rend., 37, November, 1853, p. 921. (Bogotá, *fide* Selater, Proc. Zool. Soc. London, 1855, p. 160.)

This form I have not seen. According to Chapman (1915, p. 652) it is similar to *P. u. grandis* Chapman, but is smaller, with the auricular region olive-buff; female with a suffusion of olive-buff on chin and throat.

Paramo zone of eastern Andes, Colombia.

5. *Phrygilus unicolor grandis* Chapman.

*Phrygilus unicolor grandis* Chapman, Bull. Am. Mus. Nat. Hist., 34, 1915, p. 651. (Paramo of Santa Isabel, altitude 12,700 feet, central Andes, Colombia.)

Similar to *P. u. unicolor* (d'Orbigny and Lafresnaye) but much larger; coloration paler, with ventral surface lighter in color than dorsal aspect. Wing, in male (six specimens), 90.5–94.5 mm.; in female (three specimens), 89.0–91.0 mm.

Paramo zone of Ecuador and the central Andes of Colombia.

6. *Phrygilus unicolor plumbeus* (Philippi and Landbeck)

*Chlorospiza plumbea* Philippi and Landbeck, Anal. Univ. Chile, 24, April, 1864, p. 341. (Cordillera of Santiago and Colchagua, Chile, at 6000 to 8000 feet.)

Similar to *P. u. grandis* Chapman, male somewhat paler, female grayer, with dark streaks more obscure, especially above. Wing, in male (five specimens), 93.5–98.8 mm.; in female (five specimens), 89.9–94.0 mm.

Chile and western Río Negro south into Santa Cruz.

This form is similar to *grandis* but seems to differ constantly in more obscure markings in the female.

One of the specimens taken by Pemberton at Lago San Martin is a male in first-year plumage, in which it resembles the female. This bird is marked as nearly in breeding condition, so that it indicates that the male does not assume adult dress until the second year.

**Melanodera melanodera princetoniana** (Scott)

*Phrygilus princetonianus* Scott, Bull. Brit. Ornith. Club, 10, April 30, 1900, p. 64. (Cheike, Patagonia.)

42,914-42,916, Río Coyle, Santa Cruz, January 8, 1915, adult male, adult and immature females.

The genus *Melanodera* Bonaparte (1850, p. 470), with the present species as its type, has been recognized by Lowe (1923, p. 517) as distinct from *Phrygilus* solely on the basis of color pattern. The genus is characterized by a long and pointed wing, with the wing tip so elongated that it is equal to one-third of the total length of the wing. The ninth (outermost) primary is longest, the primaries grading in length in regular sequence from the ninth to the first. In addition the bill is more conical and more sharply pointed.

The adult male, compared with a single skin of *M. m. melanodera* (Quoy and Gainerd), from Port Stanley, Falkland Islands, is clearer gray on head and back, with a less amount of green, while on the breast it is much brighter yellow. Scott records *princetoniana* as smaller but the skins compared are similar in size. The adult skins from the Río Coyle measure as follows: Male: wing (somewhat worn), 91.0 mm.; tail, 58.3 mm.; culmen from base, 12.4 mm.; tarsus, 21.4 mm. Female: wing, 89.5 mm.; tail, 56.6 mm.; culmen from base, 11.5 mm.; tarsus, 23.3 mm. (See fig. K.)

**Melanodera xanthogramma xanthogramma** (G. R. Gray)

*Chlorospiza? xanthogramma* G. R. Gray, in Gould, Zool. Voy. Beagle, pt. 3, Birds, November, 1839, p. 96, pl. 33. (East Falkland Island and Tierra del Fuego.)

42,911-42,912, 42,926-42,931, Upper Arroyo Las Bayas, Río Negro, June 4, 1912, two adult, four immature males, two females.

42,913, Lago Viedma, Santa Cruz, December 15, 1914, adult male.

The skins from Río Negro seem to represent the most northern point in Argentina at which the species has been taken. The specimen from Lago Viedma is in worn plumage.

Recently Chapman (1923, p. 12) has described a form from Río Blanco (altitude 9500 feet), Aconcagua, Chile, as *Melanodera xanthogramma barrosi* on basis of larger size. He states that the wing in the male of his new form measures 117 mm., while in typical *xanthogramma* it equals only 102 mm. Wing measurements in males in the Pemberton collection range from 102.7 to 107.5 mm., so that they

agree with the typical form in size. In lack of white in the tail in both sexes they agree with Chapman's description of *barrosi*, and in only one male is there a faint wash of yellow on the under tail-coverts. For the present they are considered true *xanthogramma* on basis of size. It is not improbable that those from Río Negro, taken in June, are winter migrants from the south.

Following are detailed measurements of these specimens:

Museum Number	Sex	Locality	Date	Wing	Tail	Culmen from base	Tarsus
42911	♂ ad.	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	106 2	65 6	13 2	21 2
42912	♂ ad.	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	106 4	64 3	12 4	22 6
42929	♂ im.	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	106 2	69 0	12 0	22 3
42928	♂ im.	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	103 2	66 0	12 5	21 6
42927	♂ im.	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	107 5	67 6	13 0	22 5
42926	♂ im.	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	102 7	62 6	13 0	23 3
42913	♂ ad	Lago Viedma, Santa Cruz	Dec. 15, 1914	102 0	61 2	11 7	21 3
42931	♀	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	100 5	62 6	13 0	21 4
42930	♀	Upper Arroyo Las Bayas, Río Negro	June 4, 1912	100 5	63 4	11 5	21 7

### *Diuca diuca* (Molina)

*Fringilla diuca* Molina, Sagg. Stor. Nat. Chili, 1782, p. 249. (Chile.)

42,942, Arroyo Anecon Grande, Río Negro, December 26, 1911, male.

42,946-42,947, Maitén, Río Chubut, Chubut, April 15, 1913, immature male and female.

42,945, Lago Mosquitos, Cholila, Chubut, March 21, 1913, male.

42,943-42,944, Río Corcovado, Chubut, January 12, 1913, females.

Peters (1923, p. 336) has recorded the large *Diuca* Finch at Paso Flores on the Río Limay, but the first specimen listed above, from a tributary of Río Cumallo, which flows into the Limay, marks a still greater extension of range. As the bird is an adult in worn plumage, taken in midsummer, it may be assumed to breed at that point. *Diuca minor* is found at General Roca and Huanuluan.

The specimen from Lago Mosquitos is albinistic, with mere indications of the darker coloration.



***Diuca minor* Bonaparte**

*Diuca minor* Bonaparte, Consp. Gen. Av., 1, 1850, p. 476. (Patagonia.)  
42,948, Arroyo Tapilque, Río Negro, October 21, 1911, male.

*Diuca minor*, a smaller edition of *D. diuca*, seems specifically distinct, as though the two are practically identical in color, their measurements, particularly of the bill, do not intergrade.

***Brachyspiza capensis canicapilla* (Gould)**

*Zonotrichia canicapilla* Gould, Zool. Voy. Beagle, pt. 3, Birds, November, 1839, p. 91. (Puerto Deseado, Santa Cruz, and Tierra del Fuego.)  
42,937-42,938, Valcheta, Río Negro, June 9, 1911, male and female.

These are of the southern type, with the crown nearly plain without lateral stripes.

***Spinus barbatus* (Molina)**

*Fringilla barbata* Molina, Sagg. Stor. Nat. Chili, 1782, p. 247. (Chile.)  
42,954-42,956, Bariloche, Río Negro, February 26 and 27, 1912, two males,  
one female.

All are adults in worn breeding plumage.

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**PLATE 12**

**The Bronze-winged Duck (*Anas specularis*)**

**In this species male and female are similar in plumage.**



*Anas platyrhynchos*



PLATE 13

The White-throated Caracara (*Ibycter albogularis*)

The first known specimen of this carrion hawk was obtained by Darwin during the voyage of the "Beagle."



**PLATE 14**

**The Patagonian Flicker (*Colaptes pitius cachinnans*)**

**Like related species, this woodpecker spends much time on the ground.**



*Wetmore*



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